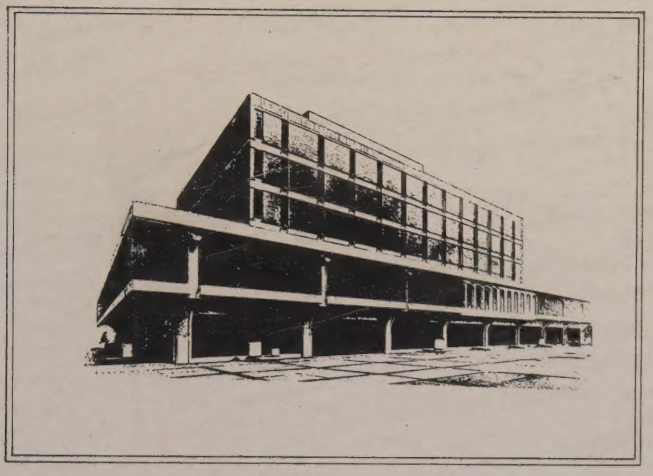

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GERMAN ANTI-AIRCRAFT SHELTER FOR MEN, 1914.

A roofing at an angle of 10° to 15°, in imitation of the field it covers. It is a proof that the Germans had developed their camouflage system for the concealment of troops long before the war.

STRATEGIC CAMOUFLAGE

BY SOLOMON J. SOLOMON, R.A.

WITH NUMEROUS ILLUSTRATIONS

LONDON
JOHN MURRAY, ALBEMARLE STREET, W.
1920

355.4
So 47

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When a man would commit a crime in a room overlooked from another the first thing he does is to pull down the blind; and, if he is using a light, he closes the shutters too.

War is a crime, and this war was, and henceforth every other war will be overlooked, and the first thing the participants need to do is to devise and prepare their blinds.

The Germans did not neglect this precaution.

59970

FOREWORD

In laying before the public this work on the Application of Art to War, which for the greater part is concerned with the analysis of photographs disclosing German camouflage methods, some words of explanation are necessary.

The evidence of German methods was laid before the authorities early in March 1918; it was not only doubted, but was officially repudiated, not once but again and again, till the end of the war. So that there cannot be in existence any official manual, dealing with this advanced and scientific side of the art.

Whether the conclusions set forth in this volume are right or wrong is a question which each reader will decide for himself; but the study which led up to them was so suggestive and instructive to the writer that he feels it may prove equally so to all serious students of camouflage. There are two schools of thought on the subject—leaving out of count the totally unscientific opinion which so long barred the way to better things; one is far-seeing, the other satisfies immediate needs only. They may be called the Strategic and the Tactical schools.

Only once during the war has the writer heard the expression "strategic camouflage" used, and that was by a statesman.

In order to deceive our "Intelligence," the Germans covered large areas of the country with huge structures designed to represent agricultural land and the normal incidents of the landscape, and I have produced evidence to show, not only how these structures may be detected, but where they might be looked for to fulfil the purpose of their erection.

Frequent endeavours were made to pass on to those in authority the information I had obtained, but in no case could any responsible official be persuaded to go thoroughly into the matter. Each of those approached, or who reported on the idea advanced, trusted to his personal view of the capacity on the part of the enemy to achieve under war conditions so vast—and, to his thinking—so futile an expenditure of energy.

Each, no doubt, took into account the fact that no British or French expert reader from the beginning of the war until 1918 had reason to

suspect the existence of a German method of concealment which differed materially from our own, or was so much more extensive. There was no constituted tribunal charged with holding an enquiry and giving judicial consideration to such matters; and personal views and decisions in regard to them are liable to prejudice and error.

Camouflage and the interpretation of aerial photography were war babies, and are still in their infancy. They are in truth, however, very subtle arts, without any tradition behind them, such as is possessed by older military arts.

The deductive faculties necessary for arriving at just or probable conclusions must depend on a combination of the following acquirements: A knowledge of the constructive and scenic possibilities of camouflage; a wide view of the ever-changing technique of war; and the painter's or sculptor's appreciation of the part played by light, shadow, and tone in the picture examined. No official reader can be said to have been so equipped.

The experience of this war has tended to make some of us believe that every man who held a safe administrative post was not an intellectual or moral superman, and even if there were some who had the judicial training and acumen to sift the evidence of a complicated subject and arrive at a right conclusion, they might not be willing to admit that for many months they had been on the wrong track and had been fooled by the devices of the enemy.

There could hardly be a greater danger to the State in war time than the continuance of a system, or lack of system, which makes it possible for any man or set of men arbitrarily to block the way of evidence which might be of incalculable value to the responsible command—a system which plays directly into the hands of any lurking enemy agencies whose rôle is to blind or mislead in matters such as these.

Since writing the book and this Foreword, General Ludendorff's *War Memories* has appeared. In vol. ii we get these passages with reference to the March offensive:

Page 589: "Such as preparing battery positions, screening roads, constructing anti-aircraft shelters, etc."

Page 596: "The divisions had at first been distributed behind the front of attack, but were now crowded together in anti-aircraft shelters behind the jumping-off places in our foremost lines. This concentration of 40 or 50 divisions had not been observed by the enemy.

"But no more did the enemy airmen discover the railway transport that had been taking place behind the front of attack since February."

Page 597 : " Every delay must have increased the difficulties of troops crowded together close up to the enemy."

Ludendorff's assumption may not be correct in every particular, but he certainly knew of the anti-aircraft shelters, constructed to conceal a great part of so vast an army, and the means taken to hide the traffic immediately behind his own lines.

Bernhardi also in 1911 uses these words, in connection with Germany's preparations : "and especially to develop the means of concealing the attacking movements."

I should like here to express my indebtedness to Mr. John Murray for his helpful criticisms and advice.

December 1919.

S. J. S.

AUTHOR'S NOTE

THE ground surveyed in a recent week-end visit to Flanders so fully confirmed the evidence culled from aerial photographs of German camouflaged positions, given in this work, that the contentions raised by some military critics that "German prisoners gave no clue to the methods of concealment employed" or "that no traces of those methods were left after the retreat" are seen to be hypotheses founded on myth.

In the village of St. Pierre Capelle every house which is shown to be incorporated in the camouflage scheme was found to be destroyed, most of them were razed to the ground, and by the Germans themselves.

Other villages near by are practically undamaged, which is good evidence of the determination of the Germans to leave, as they thought, no distinguishable traces of a secret which had remained immune from detection throughout the war by the readers, observers, and the intelligence of the Allies.

Unfortunately for them, and for all who have made up their minds not to see what they would rather not, conclusive proofs were left which the Germans never dreamt could be brought up in evidence against them. For instance, under the eaves of one of the few standing houses is a green plank, and nailed to it a remnant of tarred brown paper; folded masses of torn-down paper lie in the debris in the clearing beside the house. That tarred paper made the surface of a sham field, which was nailed up to those eaves, and so deprived the house of its shadow. It was this missing shadow which gave the first clue that the Germans were covering fields in camouflage imitation of them. Also the higher traffic was seen, by photographic evidence, to go under this field. Curving opposite to it is now found the end of a heavy log road which is about 60 yards long and has a widened platform to allow of the passing of lorries. It crosses a marshy field and two small streams, and so connects up the Fraue Forenhoff farm road with the main street in the village. No sign of this well-worn timber track is seen in the 1917 photograph. It was, of course, concealed by what in the picture is distinguishable as a camouflage field, which was high enough up for the highest traffic to pass under it. The continuation of this traffic route (indicated by arrow-heads in the book) was behind the

village, and it joined the Nieuport road about one hundred yards west of it.

This route across the fields "gives away the whole thing," for the roads through the village are now free for anything to pass along, but they were tunnelled over in 1917; and before they reached the village they were sealed—that is, the cover over the road came down to the level; for such high tunnelling could not be taken in front of houses without depriving them of their shadows.

It was only because the roads were covered, and closed on the village side of them, that this extraordinary traffic course was necessary, and the evidences now to be found on the ground are incontestable proofs of the accuracy of the reading of the photograph of an area which would hide almost an army corps, and which from the first was seen to be under obvious camouflage.

The sleepers on the railway in the central street are flush with, and indistinguishable from, the ground. In the photograph wide sleepers stand up in high relief, and the trucks are between the sets of rails, not on them. This railway was always an evident piece of Earl's Court scenery, but such crude attempts to deceive should be difficult for the-won't-have-it-at-any-price people to swallow.

The five trees on the Bruges Road among others, are sawn down to their stumps, where the returning vehicles cut obliquely to join the lane which runs north of the village, and connects up with the Bruges Road about a kilometre to the east. Those stumps are under what, in 1917, were camouflaged tree shadows, made on the top of the tunnel-cover over them. Photographs of these and other evidences were taken, and samples of some of the material employed collected, so that the official who is said to have gone on the heels of the Germans to find traces of their methods either knew nothing of his business, or has carried on the suppressing tactics which were then, as they are now, being used to mask a costly error.

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STRATEGIC CAMOUFLAGE

I

THE PROBING OF A GERMAN SECRET

We have all, by now, gathered some little idea of the part played by Art in the Great War. It was, in fact, the only possible reply to the introduction of aerial reconnaissance; for from that moment the battle-field and the landscape for miles behind it, with every incident, every sign of movement or concentration on it, were an open book to that side whose airmen were armed with the all-seeing, all-recording photographic camera.

"The other side of the hill" no longer existed, and Art alone could screen men and intentions where natural cover failed.

The perfecting of aircraft and of aerial photography will make this craft, which the unthinking at the outset looked upon as a subject for "pleasantries," an essential factor in the armoury of the strategist. So little were the possibilities of this adjunct to all arms realised at the outset by us, that not until a year and a half after the outbreak of war, and a year after it was to some extent adopted by the French, did we follow their lead.

Nor did we suspect that the enemy had already long before this developed their own peculiar methods—as soon, in fact, as they had visualised the possibilities of aircraft in war. These methods proved so successful in their results as entirely to hoodwink their opponents until well-nigh the end of the campaign. This particular system was probably little used, and not so well adapted to the fighting areas, where perhaps the German camouflage was inferior to our own, when once we got it; but it was designed on broad lines, for the concealment of great bodies of troops and of those activities in back areas which might give the much-sought-for intelligence to their opponents.

From what we now know of the early days of the war, and from what follows in these notes, it will be obvious that the enemy's preparations in this direction went on *pari passu* with all others dictated by the entry of aircraft into warfare, and were so stupendous in scale, so original and unexpected, that, together with the Zeppelin and submarine,

they were not improbably among those material advantages which precipitated Germany's decision to fight.

During the first days of the war accounts were given of the part played by German airmen in marking the range of tactical positions for the benefit of her artillery, for which, of course, signalling was prearranged. Her aerial photography was at that time of a high order. Not until we had captured a German aeroplane, and developed the plates found on it, did we know what the camera was capable of in this direction.

Anti-aircraft guns were shown at Munich some years before the war. The Swiss camouflaged their guns before 1914. We can imagine from what source this idea emanated. So it is obvious that most of the functions of the flying machine had been foreseen by the Germans some time before the declaration of hostilities.

The wise inventor of an aggressive arm, when once it is perfected, turns his attention to its antidote; for, in the course of a long war, no innovation is enjoyed exclusively for any length of time by any one of the belligerents.

The only answer to aerial reconnaissance is concealment from above, or confusion where concealment is impracticable. Germany, with her usual foresight, and with all her energies and abundant resources concentrated for some years on the means to subdue her neighbours, would not neglect preparations, however vast, for what she saw was to become a potent factor of her strategy. Whereas the Allies were forced by necessity to improvise some rough-and-ready screening from the aerial view, Germany, evidently realising the value in surprise strategy of concealing all concentrations and activities possible on an extended front, had already perfected her system of camouflage, in so resourceful, so scientific and so adaptable a manner, that it is inconceivable that such perfection can have been obtained without long experiment, carefully planned organisation, and special discipline.

In analysing her camouflage, it will be found that she has adopted the only sound principle, that of photographing the area to be dealt with, making from the photograph the initial models of roads and structures required, and reproducing in them intact the features of the ground they covered as seen from above: the conjurer's false bottom.

So clever is this camouflage, that only where some insuperable technical or artistic difficulty has had to be met, is it possible to find an incriminating clue, and only then by the eye and mind trained sufficiently to detect the slightest deviation from the inexorable laws of light and

shade, and the subtle differences between a horizontal and an oblique plane. The same trained eye and mind are needed to see through the distorted perspective, countershading, and the innumerable constructive and other tricks resorted to, which perhaps more than anything else reveal the mentality and the cunning of the able German military artists.

Before attempting to follow detailed analyses which disclose their methods, it would be as well to grasp what appear to be the object and the advantages of a system of concealment which has not only remained a sealed book hitherto, but has most probably been the means of springing disastrous surprises on that side which had not equipped itself with the science needed, to detect the false from the real, the natural from the artificial, in a picture taken from a height of about two and a half miles.

The following diagrams will show good reasons for the adoption of the methods employed, and the great advantage which they afforded, in economy, in covering capacity, and immunity from detection over those adopted by the Allies.

These diagrams illustrate its governing principle. An erection with upright sides (Fig. 1) will cast a marked shadow on the ground according to its height and the position of the sun (Fig. 1). But if its sides slope

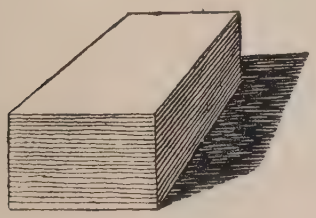


FIG. 1

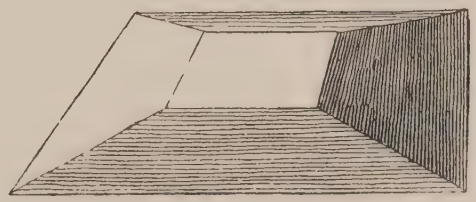


FIG. 2

gradually to the level, as in Fig. 2, there will be no cast shadow, and the sloping side in half-tone is at times made by the Germans to represent a flat field bearing vegetation, thicker than that on the lighted planes.

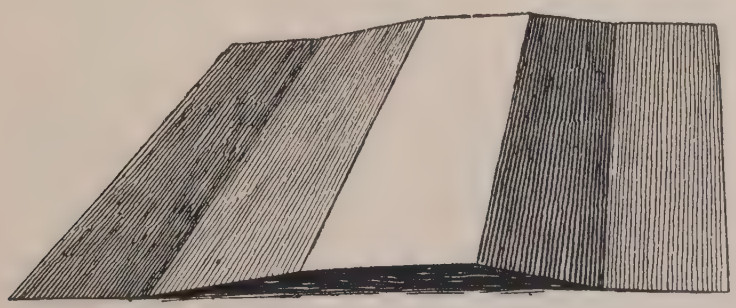


FIG. 3

[1] By the way, the airman will tell you that these cannot be detected. Did he learn this fallacy, among others, from the enterprising German?

For, in an aerial photograph, the thicker the vegetation the darker it appears. Plough and fallow show up light, and a smooth road white, for smooth surfaces absorb less light than textured ones (see page 6). The adoption of the sloping sides and ends of the hangar or series of hangars, large enough to cover in a whole field, or several fields, will make them appear to the reader unskilled in camouflage possibilities like so many strips of vegetation, fallow or plough, according to the surface they offer to the sun.

German Shelter for Men

See Frontispiece

This shelter, by no means an impromptu erection, was put up before September 1914 near Antwerp, and is a good illustration in small of this camouflage principle. Note the very gradual slope and the covering material which is nailed over boards. This from a height would appear like a flat fallow field, and is a key to much that follows.

If we take one of our huts, 60 feet by 15 feet, which, with its pent-house roof and upright sides will cast on the ground a shadow that is well-nigh impossible to conceal, and spread out the covering material of which it is constructed, it will afford quite three times the covering capacity of the original construction.

On the German principle it will be used as in Fig. 3.

So that the covering material of ten huts which cannot be concealed because of their shadows, spread out over a field in German fashion, will cover at least three times the number of men that the original huts would, and will, if artistically done, be practically indistinguishable from the solid ground it covers (Fig. 4).

600 Men 1800 Men

Fig. 4

The fact that contiguous light and dark fields do resemble possible erections in the photograph, that the camber of roads sometimes appears exaggerated like an arched cover over them, and that paths across fields might be at times taken for pipes, most likely suggested the means adopted to a people, whose every thought was directed through a military channel, and who for years previous to the war had encouraged for military ends a regular service of dirigibles between Potsdam and Berlin ; and so to whom the aerial view of the landscape was by no means a new sensation in 1914.

In Flanders and Northern France, which Germany knew would be the seat of war, the country is cut up into small irregularly shaped fields of varying growth, most suggestive of odd constructions in the contiguity of their light and dark patches ; and with a little manipulation they could be made to look so like actual buildings in a photograph that our men bombed what looked like a huge hangar, and found out they had bombed the worked fields.

These ground-pictures are the subject of a chapter which follows, and the method is explained ; but the ruse had its hypnotic influence. The real erection would look so like these fields they bombed, that without a knowledge of the possibilities of camouflage and the science of skiagraphy, the reader would not know the difference.

When the original report of the discovery was written in March 1918 definite evidence based on the few photographs then available, was given in support of the contention, that this camouflage was to be looked for in places a few miles behind the 1916 front, on high-roads, near railways, and on slightly rising ground (to facilitate the necessary drainage and water supply), and that it would be used for the staging and concealment of vast numbers of reserves during daylight, whenever a surprise attack might be contemplated.

Five hundred thousand men could be billeted in a town like Lille, or Roubaix, and there would be no indication whether they were to be sent either to Dixmude or Arras ; so there would be little need to resort to extraordinary methods of concealment in such places. But if 30,000 men are sent to a camp in the Northern Sector, they are obviously not destined for Arras ; they will be used on that particular front, and it is such camps that call for effective concealment and where elaborate camouflage methods are to be expected, and where they will be found, if a careful search is made in those districts which offer the required facilities, and where natural cover failed.

II

CAMOUFLAGING THE GROUND

THIS is the German description of what might be called "ground pictures, a science which must be understood before one can attempt the interpretation of photographs of positions occupied by the Germans, more particularly those in back areas, and can be best illustrated by some early experiences and observations.

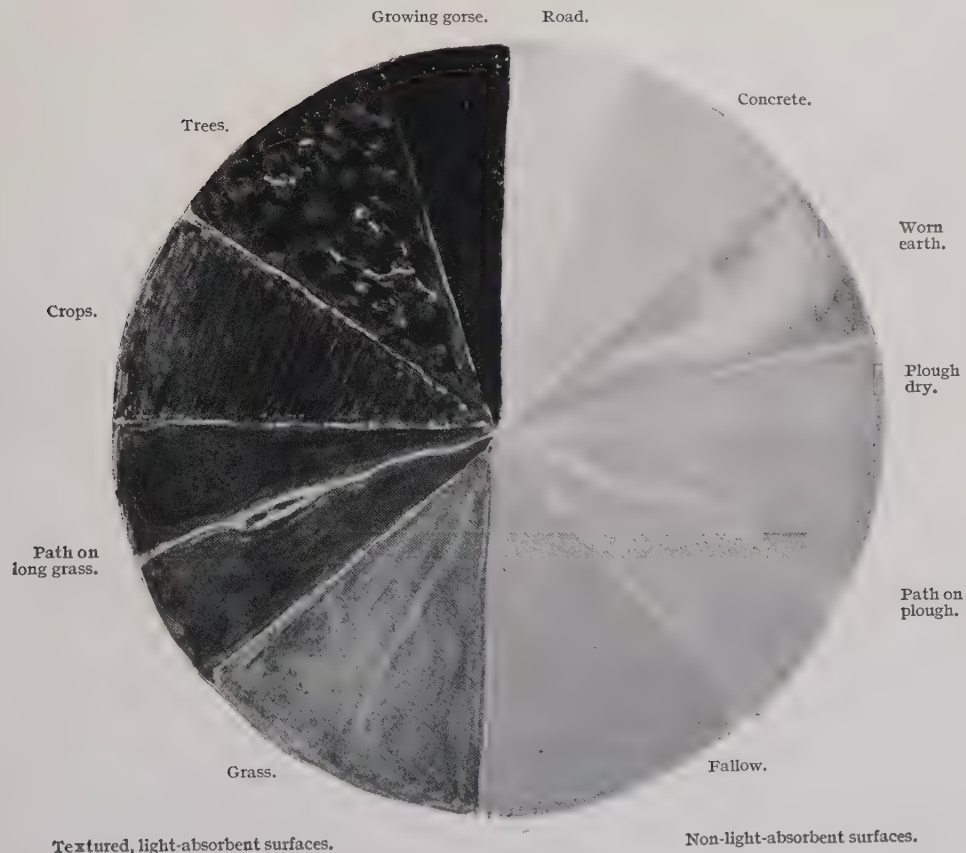
In this photograph of Ypres, what remained of the Cloth Hall in 1916 is seen to cast its long afternoon shadow on the white "Place" on which it stands. Behind it to the north there is a patch of grass at the back of what was once the Cathedral, some of it in full light and some in shadow. The grass fully lighted by the sun, it will be noticed, is of exactly the same tone value as the shadow of the Cloth Hall on the white "Place." Observing this, I made a careful study of photographic results, and with a class of officers under instruction, made a point of going over an area of which an aerial photograph had been taken, photograph in hand, and with them compared the relative tones of the different growths and other incidents, such as trodden paths, denuded earth, concrete, and so on.

This circular chart gives roughly the results of those investigations, which should, by the way, be pursued to the utmost possible limit, for the future guidance of all camoufleurs and readers; so that not only these elementary observations should be familiarised, but it should be possible to determine the nature of any particular crop or growth at all times of the year, in any reasonably clear photograph, taken from a height of twelve to fourteen thousand feet. Nature unaided gives a whole gamut of tones for the ingenious ground-artist to play with.

The class was then shown how, by removing a patch of turf the shape and size of one side of a pent-house roof (which would tell white) and by darkening the grass beyond the square of turf left to represent its shadow side, it would be possible to make a ground picture of a house casting its shadow on the ground, which might well confuse an inexpert or careless reader.

YPRES, 1915.

The plot of grass under arrow-head in sunlight is the same tone as the shadow of the Cloth Hall.



RELATIVE TONE VALUES.

GROUND PICTURES.

Such imitation shadows placed to the north side of the denuded patch would appear sufficiently logical for a greater part of the day. But of course the expert looks, or should look, for other indications besides these crude attempts to deceive.

It did not occur to us at the time that we made these elementary designs that the Germans knew all about this and were practising it. We live and learn. Before war prejudice had blinded most men of judgment; the Teuton mind was considered a probing one, that exhausted every subject it dealt with; and there is little doubt that on this question of camouflage he has lived up to his pre-war reputation.

Anyhow, their ground pictures are of an order which any artist camoufleur must respect, from the point of view of resource, ingenuity, and adaptability to the position in which they are used. They are so accomplished that they have often made it difficult even for the expert to distinguish between the ground picture of hangars, and the real erections, without the minutest investigations and comparisons. And, just as dummy earth-works are made in the vicinity of the real, so these ground-pictures are to be found near up to actual erections. Had this subject been properly and scientifically studied in time, we should not have needed to wait till it was too late to know what was "up" in the neighbourhood when they appeared in aerial photographs of German positions.

Here are a few examples, taken from many, which exist in the photograph of Sparappelhoek to be found on page 40.

(A) Some houses and huts, (B) a big erection, (C) the imitation of a hangar like a ship keel upwards, (D) also to look like hangars, (E) is the real aerodrome near by at Aertryke. The planes are out in front of the hangars; a very restricted and congested landing-place. Either the German fliers are abnormally skilled or the camoufleur (which is more probable) has made pictures of the hedges, including a small hut, around the fields over which the planes can run unimpeded.

Some idea of the method pursued will be given by an analysis of the part of an area photographed on May 10th, 1918, at 5.30 p.m., obviously intended to be taken for field hangars, to be seen on page 44. The other part will be analysed later. Facing it there is another photograph of this area, taken six days afterwards at 11 o'clock. Had they been the real thing the light and shadow would have been reversed, but the one is the counterpart of the other, except for the light and shade of the shell-holes and earth-works. Nor is there the slightest change discernible in the cart-tracks across the worked fields or elsewhere, except in their light and shade, although six days' real traffic would have shown some further sign

of work wear. Cart-tracks almost invariably tell lightest on the grass, and are comparatively faint in contrast with the fallow over which they are made. The artist here makes his tracks quite white on his light surfaces, and they almost disappear in places on the darker ground. Also some of the tracks are waved to suggest the contours over erections with sloping sides. His picture is designed to appear in relief at midday.

The whole area was thickly shelled, as we see on the right of the road. The difference of tone between the squares of varied growths, almost obliterated by the wild growth of neglect, is faintly discernible. But to the left of the road we have the marked differences of tone which must be interpreted as evidences of thick vegetation on some strips, and on others harrowed earth of the smoothest description, very like the surface quality of concrete. And the shell-holes are fewer and farther between, and of a very different character to those on the unworked fields, notably those towards the bottom of the photograph, which are very mechanical, unstarred rings, the whole suggesting that these ground manipulations are more recent than the date of the great advance made into this region two months previously.

A good camouflage maxim is, " Make your dummies at the same time or before your real positions." Nothing is better calculated to confuse. Judging from the soundness of the camouflage instructions found on German prisoners, they have taken the science pretty seriously and have little to learn.

The rest of this picture, and the object of these various manipulations, is quite another story, which we shall come to in due course.

III

STRATEGIC CAMOUFLAGE

St. Pierre Capelle, 1917

A study of the map[1] shows the military importance of this village at the junction of the Bruges and Ostend-Dixmude roads, which rise a few feet above the surrounding fields—causeways in a marshy district. The village is just eight kilometres from Nieuport, protected by the flooded area that runs south of that sector, opposite Ramscapelle. It is the last resting-place for troops on their way to the West Flanders Front. The road from the village to Nieuport is in fact the only communication there is in this neighbourhood, and necessarily must have been used at all times of the day for supplies to that sector. In these circumstances it is somewhat strange, that although a kilometre of this road running south-west of the village could be overlooked without interruption, and activity in its neighbourhood clearly seen, no transport or activity of any kind was ever observed on that road.

Did it never occur to any one to enquire why? This sector of the road was, of course, entirely covered in; the observers would see only the top of the cover. The saving of life and transport from our guns, for which the observers would be keeping watch, was in itself sufficient justification for all the pains taken to screen the road in the way adopted.

In spite of its obvious military importance, and the indications, false or real, of some military uses to which it was put, there is hardly a sign of moving life in the whole photograph, if we except a dummy horseman leading another horse into a black opening, fashioned to imitate three horses ahead of him. Imagine Poperinghe, a dead city, without a lorry on any road, and no other sign of life in a midsummer photograph taken of it, of extraordinary clearness and sharpness. In point of fact, the Germans could never have counted on our getting so perfect a picture, nor otherwise, would it have been possible to make the detailed drawings which disclose the imposture.

It was from this photograph that the first indications of German

[1] A map will be found at the end of the book.

strategic camouflage in back areas were discovered early in March 1918. An imitation field behind a house, really a big hangar under which traffic goes, gave the clue, that the covering of fields for staging purposes played a large part in the system. A cunning device; for a cultivated field is the last place on which an airman wishes his bombs to fall, and no other form of camouflage for camps or concentrations secures invisibility. Tents or huts are impossible to hide in the open, whereas there is nothing to distinguish a roofing made artistically in imitation of the fields it covers from the actual ground. Even a stereoscopic photograph will not disclose the secret. And if a small field can be imitated, why not a large area? A determined people with such a good idea will always find the means to give it material expression, and learn how to surmount technical difficulties connected with its realisation.

The amount of material and labour needed, the vastness of the enterprise, and the prescient organisation called for, to guard against detection while in the making, are factors that have made the whole thing unbelievable. The Germans counted on this, and were psychologically not far out.

But we shall see what a careful analysis of every inch of the photograph discloses. In photographic enlargements some detail is lost, and these drawings are as accurate as it is possible to make them, drawn as they are with the aid of a small magnifying glass, before the enlargements were made.

Highly magnified photographs are among the illustrations, and reference to them should satisfy the reader, that the drawings are in no way exaggerated or biased by any preconception. It will be noticeable that in such enlargements the delicate differences of tone in the lighter passages are sometimes missing.

Some of the drawings are of the nature of diagrams, indicating constructive lines and planes, and do not pretend to reproduce the photographic effect, but authority will be found in the photograph for all that is in them.

An attempt to describe the very gradual accumulation of facts and deductions which lead up progressively to finds would be tedious, but this may be said of the interpretation of the mass of microscopical detail in a photograph of the kind under discussion, covering as it does a crowded area, that an ordinary examination, even with a good glass and in the most powerful light—which are in every case essential—does not suffice. One may not see enough to suspect the first clue, the discovery and verifying of which is all-important; but, for a thorough constructive

and synthetic analysis, the only way is to make enlarged drawings, and sometimes experimental models. There is no process of thought more exacting or logical than drawing. Every line or combination of lines, every shadow, every nuance has its meaning and its message. Here endeavours by means of cunning art and science have been employed to confuse and prevent suspicion, and no one who has not passed much of his life in the use of line, tone, and shadow, to produce effects of solidity on a flat surface—such as the artistic use of them will give—could possibly cope with the tricks and devices here employed to neutralise the sense of bulk. Equally necessary is a knowledge of camouflage possibilities, of military technique, and natural phenomena. And, what is also valuable, the making of drawings or models checks any tendency to misinterpretation; everything must explain itself and fit in as accurately as an architect's plan and elevation. Although there is less harm done in suspecting too much than in ignoring what may be dangerous, for suspicion is the mother of detection, yet the making of drawings would be too deliberate for the examination of the hundreds of photographs taken of active areas; but it is the kind of training needed in every case; the eye so practised will see what will elude the untrained vision.

IV

ANALYSIS OF PHOTOGRAPH OF ST. PIERRE CAPELLE

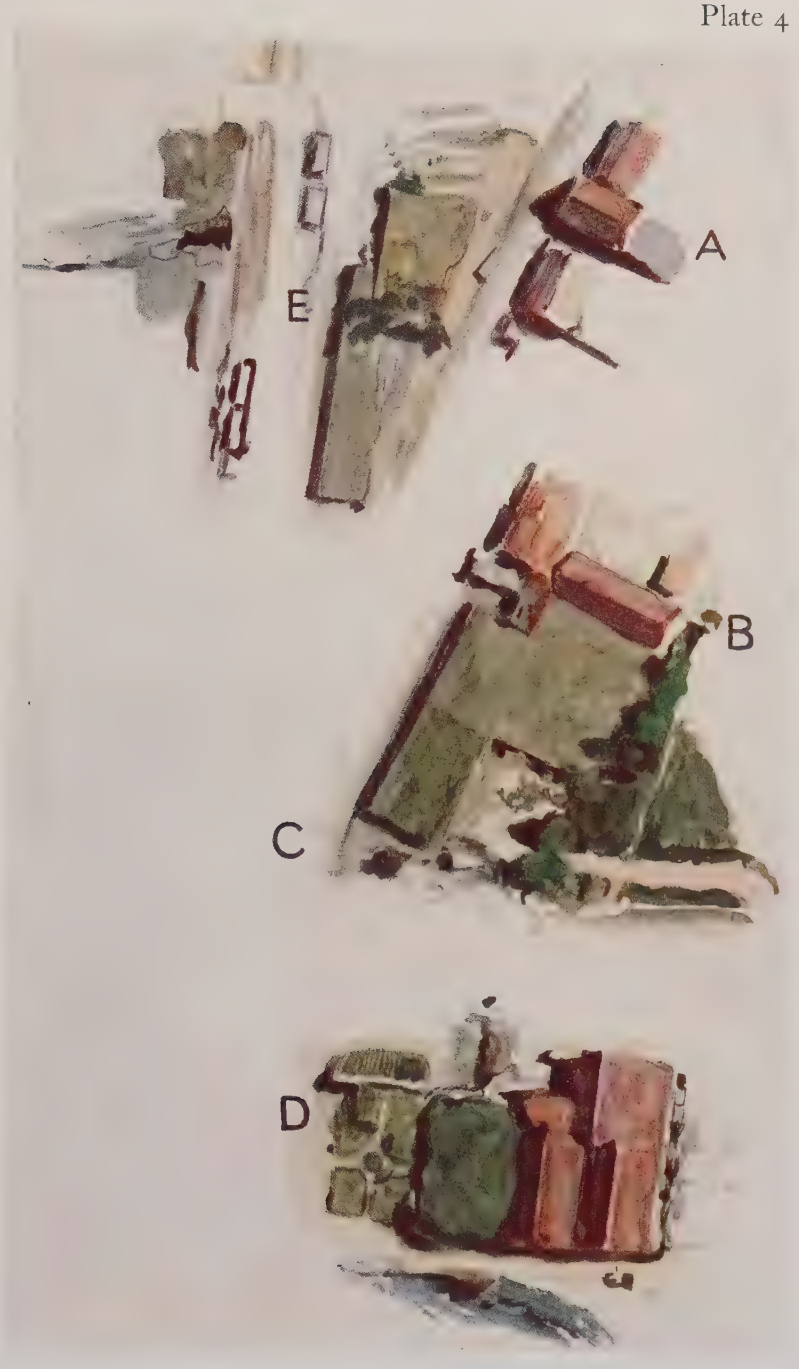
In this drawing it will be seen that a considerable shadow is cast on the ground by a house sketched near the top (A). A little farther west another house in exactly the same parallel, (B), has no shadow at its side; obviously something intervenes, and comes up to the eaves of the roof. That represents the height of the hangar, which is made to imitate a rectangular field alongside. The shadow of this false field is seen on its north and west sides; and the projecting oblong attached to it (C) differs in texture from the rest, and sags somewhat between its supports. A little west of this in a similar way a garden is raised in front of a double-roofed house (D) under which a stream runs; while another pair of low hangars (E), with a lean-to on the south, has a camouflaged bush extending over its width, and represents a mound at the junction of the road and the railway.

Sketches of these three hangars, with their positions in the village, were forwarded to the proper quarter. A few days afterwards an official report appeared in *The Times* that three hangars at St. Pierre Capelle were bombed. If it was worth while to bomb three hangars in 1918 (by which time the mass of material had been removed, in preparation for the March offensive, farther south) the readers had evidently not understood the indications in the 1917 photo of this village.

Encouraged by this announcement, other suspected objects came under the glass. On the face of it the most suspicious was a sunken tramway running between the Nieuport Road and the back of the village. Evidently it is a military tramway, for it ends with the yards behind the houses. A sunken tramway, or even a sunken road in an area where every field is surrounded by a ditch, and in a country where in winter if you dig down two feet water oozes! Surely something must be wrong. This calls for most searching enquiry.

A photograph of St. Pierre Capelle will be found at the end of the book, and should be opened out now for reference.

Let us begin where the tram-lines end.



THE FIRST INDICATIONS DISCOVERED

To face page 12

↑
Cover over dip through which the traffic runs.

UNDULATING TRAM LINES ARRESTED AT THE OBSTACLE.

There are three branches to this single line across the dummy stream, running over a switch-back course, lines that no truck could possibly travel over. Then a great bulging obstacle (see drawing). Then no sign of lines till we get to the tunnel which is joined on to the cover that screens the Nieuport Road from the eyes of the airman. On this short length of white, two rudimentary lines of a much larger and very capricious gauge are rather faintly indicated. We shall wander along this road again, but meanwhile we may ask ourselves, why this circuitous course if the fields are flat? Why make these lines so much longer than necessary? They have crossed cultivated fields anyhow, and there is no other obstacle to a bee-line.

This is where the camoufleur comes in; the course is indicated, for camouflage reasons, right across the middle of the hangars. It was necessary to introduce a strongly marked incident of black shadow and white material, in order to flatten by strong contrasts the tones made by pent-house sides and other incidents of less violent shadow; and what is more important still, to give an appearance of solid earth to the field hangars; and for this reason the road goes well across the middle of the group, unfortunately indicating, in spite of every attempt to avoid it, the contours over which it is modelled. Actually the white part of the sunk ways is flush with the planes of the hangar tops, except here and there for reasons which shall be explained. A ridge of varying height of papier-maché-like bobbles is raised on the south side of this road, casting shadows of varying lengths throughout its course; and this is how the sunken road effect is produced. And a very rocky road it is. At the apex curve, and throughout its descent, note the modelled up masses. The dark long strip, parallel with the white path, is made to represent vegetation thicker than that on the contiguous strips, but is actually a toned oblique plane, the obliquity of which, if the sun were in the east and of course lower, would be very marked if it were not for the light-catching, upstanding masses; with them, the darker tone or almost shadow would only be a darker flat strip, with a well-lighted-up road cutting through it (see page 22). Here we see the hand of the artist.

We now literally descend towards the stream which the sunk road is supposed to be careless about crossing. There are things which can be drawn on paper, or done in modelled scenery, which can destroy the sense of space, and defy the elements, which cannot be equalled in nature. Just as Hogarth, in an engraving illustrating perspective anomalies, makes a man stand at an upper story window, lighting with a candle he holds the pipe of a man on top of a hill a half mile away.

When we get to the stream, in which there is no sign of water—at least at this point—we see a rough attempt at a bridge, with two cupolas on its top, over which no tram could possibly be pushed, any more than across the other obstacles throughout the course of the road; they would be too serious for any man to surmount. And beside the bridge are the projecting indications of the lowest plank of the hangar which joins the Nieuport Road, with broken earth at its base; and up the sides of which the sunk road calmly meanders sideways. Here the shadows cast by its raised bank to the south are so long, that were the surface on which they fall a perfectly horizontal one, the bank making them would be as high as a house; but the hangar side slopes no less than 15°, of which the width of shadow is but one indication. And then there is another rise, and then a fully lighted top flat plane. Near the road see the path which gets more attenuated and tired as it mounts, sometimes even stopping to take breath. Parallel with this and the road is a raised bank, the north shadow of which represents the ditch; the same phenomenon can be seen on the shadow side of the Nieuport Road cover, turning at right angles into the field, where it stops.

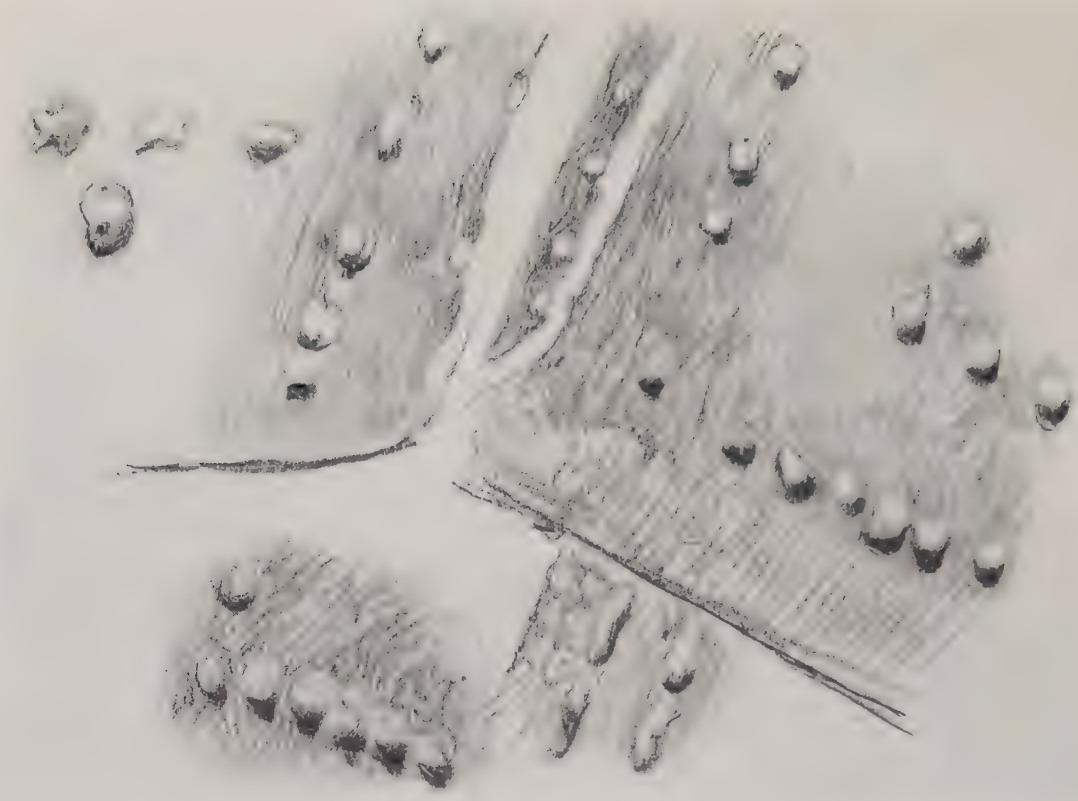
If one cannot have a ditch on a hangar, one must make the nearest approach art will afford to such a depression. Meanwhile, of course the sunk road is ready to be filled with all the drainage, and is competing seriously with the stream through which it runs, for its bed is made to appear at least as deep as that of the stream. But the stream, not to be outdone, is found high up on the hangar heights to its south.

For the purposes of the "Intelligence" this alone gives a clue to the character of the whole area and the methods employed. But our object in these analyses is an endeavour to hand on to future students of this subject knowledge a little less elementary than that hitherto given, and which unfortunately was considered adequate during the war.

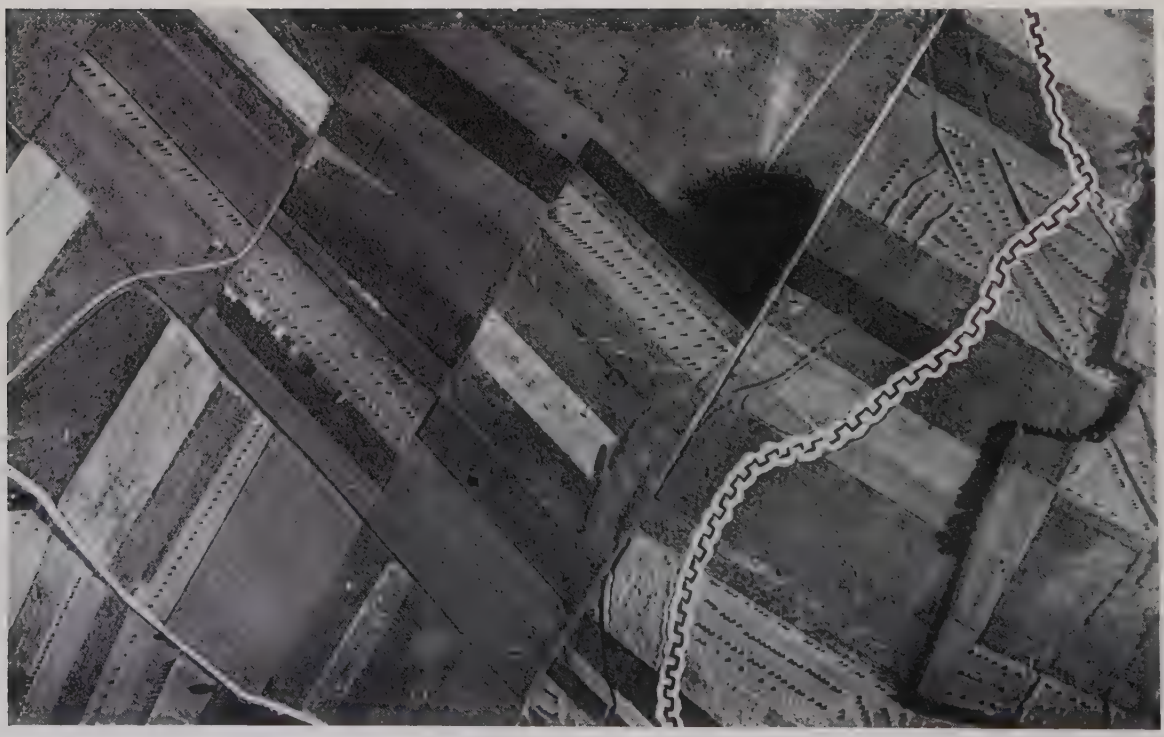
FALSE TRAM-WAY ON A LEVEL HERE WITH THE BED OF A STREAM. IT CURVES UP THE SLOPING SIDE OF A HANGAR TO JOIN THE NIEUPORT ROAD.

The ditch alongside the road is imitated by the W. shadow of planking.

PLATE 6.



DUMMY HAY STOOKS.



REAL FIELDS WITH REAL STOOKS.

V

CAMOUFLAGE METHODS

Stooks

Much trouble, it would appear, was taken to reproduce the stooks that were probably standing on the fields at St. Pierre Capelle when a pre-war photo was made of this key to Zeebrugge, from which in all probability the original working model for its camouflage was designed.

The fields immediately behind the village are but slightly and very gradually varied in their levels. The shaded planes and construction lines of the hangars we see make this difficult to believe; but it is best not to judge entirely from appearances. We have seen what that might lead to. Some more scientific test is needed here. The drawing of stooks will help us. Examples are given of those on two of the top strips of field—about thirty yards apart in the photograph. It will be seen on careful examination that on one plane the stook shadows are short and cast to the north-east, and on the other the shadows are longer and cast to the north-west, indicating a descent on two opposing sides of at least 20°, which would occur in nature on the crest of a hill.

In this drawing are also shown some dark stooks curiously placed on the wrong side of the drain or path, and the shapes of all of them are quaint. A stook in France or Flanders is nearly always a perfect dome, standing high up on the field.

The accompanying photograph is of real fields with stooks on some of them. It is interesting to compare these fields with the imitation ones.

These stooks, anyhow, served their purpose. The most trusted of the French readers, an expert in discovering clues in fighting areas, but who had a fixed idea that no camouflage could deceive him, could not imagine that camoufleurs would take so much trouble. The making of a few hundred papier-maché mounds would certainly not deter the manager of Grand Opera or of Drury Lane Theatre from mounting a ballet, in which such *decors* might be needed for the *mise-en-scène*, so that it is hardly credible that the German who made up his mind after forty years of preparation to dominate Europe, would hesitate to give these very

convincing touches to his work. Their very numbers helped the illusion.

The superimposing of such stooks, dummy houses (of which we shall see some samples later on), or any apparently weighty, bulky object on the hollow landscape, is the most effective means of imparting a sense of solid ground to these structures, and of deceiving the uninitiated.

This is an age of specialists. The fighting areas in which the photographic reader's quarry is mostly to be found, keep him so busy and his attention so focussed, that except for an occasional search for a long-range gun or anti-aircraft batteries which are known to be in definite areas on the map, he has neither the time, the inclination, nor the special training to go exploring in search of the unexpected. Moreover, the photographs used for illustrating this book have in them all, either marked guns or anti-aircraft guns, or they would not perhaps have been taken. It was for these things mainly that the reader was asked to look and for the observer to keep watch.

The feather which excites the game-keeper, will in all probability not be seen by the spectacled entomologist who is in search for beetles on the same piece of ground.

Field-hangars at St. Pierre Capelle

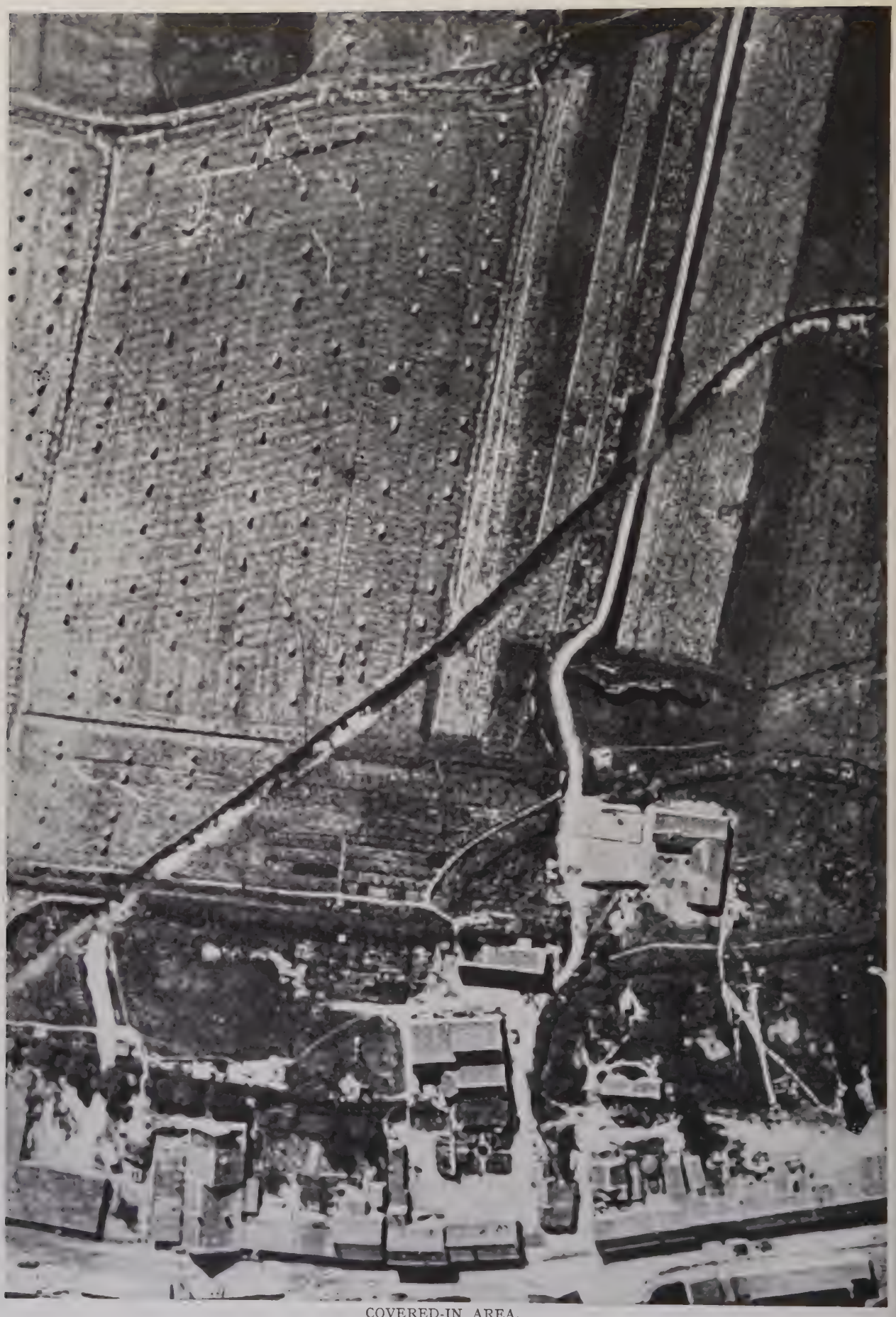
The hangars in imitation of the fields are the main strategic device. A field a hundred yards square will contain a brigade, so that five such fields would hold a division and all its impedimenta. The difficulty of constructing such hangars was always the stumbling-block to belief in their existence. That matter will be gone into more fully later on, but a close examination of these is advisable at this stage.

Why this Spot was chosen

In the map there is a 3-metre contour-line about a hundred and fifty yards on an average behind these hangars. A stream, or the bed of a stream, runs at their northern limits; and village houses through which, and through the yards of which, covered access is devised to the hangars.

Let us try and realise the importance of the selection of this spot for its particular purpose.

The district is marshy. The slight elevation of three metres (two above sea-level), sloping down towards the stream, provides at least the needed drier ground a little above the other low-lying fields, and a natural fall towards the stream (somewhat steeper on the west side) for the drainage of the roofs. Collected pools on such large expanses might be fatal.



COVERED-IN AREA.

Note the breaks in the metallic surface of the big field and the blistered joints between the fields.

The natural fall is augmented by the pent-house sides or sometimes curved roofs of the erections themselves, so that, taking their south to north run, their varying heights added to the level at 200 yards back from the stream (where presumably they begin) would ensure an adequate fall. And there is cross-drainage at intervals to take off rain east and west. Such undulating ground makes problems in other directions easier of solution. The few feet added to the existing varying levels are practically unnoticeable from above, and we see, even in the photograph, have escaped detection, whereas erections raised on perfectly level ground might easily attract attention by the change made in the general aspect. And, moreover, there would be no natural drainage—a necessity both above the covering material and on the ground below. Such considerations, with the strategic requirements referred to in these pages, would be borne in mind in any search made to localise this extraordinary form of camouflage.

The analysis of the construction of these hangars and artistry shown here will amply repay the enquirer into German mentality and methods. The width of the widest pent-house-sided shed is about the length of four houses, say thirty yards; most of them are much less. In the one instance of the wide-curved roof, metallic corrugations run north-east towards the drain provided on its east side and north-west on the other. They are added facilities for drainage to carry off rain-water, but they also accentuate the steepness of its curve; and the breaks in the thin metal seen near the top of this field, follow the modelling of the corrugations. These are clearly not defects in the photographic plate, but testify to the hollowness of the whole thing (See enlargement opposite.)

Again, the doubting enquirer who had not noticed the divergence of these ruts, nor the breaks in the covering material, may say, that such corrugations might be found on any worked field; but on this, and another narrow strip alone, are such as these found, and we may assume that most of the fields had been under similar cultivation; the hay-stooks are evidence of this. On nearly all of them also are discernible the joints of the wide boards necessary to form the rigid surface required.

From the point of view of construction, when one has reason to suspect that what we see are erections, and not flat fields, there are many other things about which one has to satisfy oneself, such as entrances and exits, and how the sides are brought down to the ground so that the sense of bulk disappears, or is accounted for. Cleverly designed as these are, each hangar or group gives up its secret.

Close Analysis

This key drawing indicates the rise and fall of pent-house sides, the inclination of which can be checked by the direction and length of stook shadows, as well as by the tone of planes either fully lighted, or sloping away from the sunlight. Any one of the analyses which follow thick upon each other here suffices to show the artificiality of this area.

With the aid of the key drawing, points referred to in the text can be found in the general photograph at the end of the book.

Subsequent references to the highly magnified photographs will enable the reader to see all detail more clearly, and better still if an ordinary magnifying-glass is used.

A path, probably roughly in a line with one on the real ground, divides the two sets of structures, and since a path that is used must logically go on till it reaches another path or road, we see a slight lightening of the base of the hangar (A) which runs at right angles to the main group; that is supposed to be the continuation of this central path on its way to the road to the east, but certainly no one would guess that this blur is a real continuation of the elsewhere clear-cut lane. The constructive lines and planes around this are fairly obvious, and we find two breaks (actual breaks, not photographic faults) on its sloping side at (B). The material is bent back in the smaller break and is hanging in the larger; and there are small drainage holes near them, in the ridge which forms the outlines of the south side of the black hangar, of which the rugged surface has no counterpart in nature.

The white agricultural glass frame really slopes down towards the property bushes; it is smaller at its east end than at its west, due to a perspective reduction, and the stream near by runs also down-hill in sympathy, the bends in its course indicating the constructive planes of the hangar at its northern ridge (I) where it descends gradually towards the Leke Road. The stream has a surface almost as rugged as that on the hangar. Altogether this mass accounts for the bulk of the hangar group on the east side, and, unlike a flat-ground picture, every elevation can be consistently accounted for.

Then we have the tin-like arch at D into the jaws of which the main central path runs. The shadow on its north side shows that this tunnelled apex is raised high up above the planes around it. Proceeding along the path a little to the west we come to a haystack right across the middle of it (E). This does not matter much, seeing that no one but the camoufleur

KEY DRAWING TO THE TEXT ON ANALYSIS OF THIS AREA.

Breaks in covering material.

Pipe

mmy
ream

Dummy Tram lines.

COVERED-IN AREA.

has any right up there, and he could get along under the haystack, which is only a papier-maché imitation, hoisted up. The path continues its undulating course, and at F there is a considerable dip, marking the fall for the sake of drainage between the curved hangar and its neighbour, with the curious bobbles along its course and at the junctions of hangars. This system of joining material is not happy, it is utterly unlike anything known to the agriculturist. As we go on, the path almost disappears at (G); there, there is an overlap, making a distinct outline shadow crossed by a snake-like bit of piping.

The overlap of the next dark field is seen marking the contours below it, and at H a construction angle hidden among the stooks divides the large hangar top into two descending widths. The shadows of the stooks on this are consistently north-west. Then a more acutely descending side, brings us to the stream, which runs between this and the hangar joining the Nieuport Road, and altogether with the sides of the wooden curved erections north of this—over which the tram cutting is made—the descent of the west side of main group toward the ground is accounted for.

And now if we go again to the stream towards the east, and proceed to the west, we shall find more anomalies and some very interesting construction devices. At J there is a black opening, surrounded by imitation white spoil, big enough for men to enter, and whereas the field to its east ends almost on a level with the bank of the stream, that half on the west has a curved slice cut out of it, which descends in terraces from its apex (along which a path runs) to the level. A distinct straight pipe is placed at K and is seen clearly throughout its course to the south. It is painted white where it crosses the central east-west path, and runs along the top of a ridge in the widely furrowed black field, the dark tone of which is not vegetation, but is due to countershading. From the point of view of construction the next device is hard to beat. The black square of field at L protected north and south by a hedge and which has on it broken earth in patches, and is evidently not cultivated, looks innocently flat at first glance; but on close examination it will be seen that it is composed of three irregularly formed wedges, which account for the final slopes of the hangars south, east, and west of it. A good glass and light disclose the fact that the patches of broken earth are lifted above the level, and a small white flap in this happy valley, with a hole under it, is another entrance for men or a vent of some sort.

To the west of this, where the tram-line mounts towards the sunk road, there is a very unagricultural curve, and then what is supposed to represent a path, but is really an overhead screen made of an open textured

material over wire, which covers a dip through which the higher traffic might well run at M.

This traffic route is marked on the key with directing arrows. The terraced kitchen-garden (described in detail in a subsequent chapter) with the entrance to the hangars through the cottage, comes next.

Then mark the curve which encloses the spade-like field (at O), and is continued by the line of trench which never was, and never will be, a real trench, to the west at P. That trench-curve marks the point of contact with the side of the hangars, and of the material which slopes gradually down to the edge of the stream. All these account for the north sides of the hangars, the "design" of which is perfectly clear although extremely resourceful.

This isometric perspective should make the whole thing realisable. Every feature of the photographic plan is seen to perform the function allotted to it in the elevation, and it solves many of the mysteries which were unintelligible before one had time to exhaust the great amount of material there is here for investigation and thought, problems which have taken time to solve. One could not make an isometric perspective of level fields such as this, accounting as it does logically, for the three dimensions, drainage facilities, the needed traffic possibilities, entrances, and whatever one can conceive necessary for the concealment of perhaps a division of men, great dumps, and so forth.

THIS DRAWING GIVES THE ELEVATIONS AND GENERAL PLAN OF THE FIELD HANGARS.

Plate 12

ENTRANCE TO THE FIELD HANGERS UNDER THE WHITE FLAP

To face page 21

Detailed Analysis of Points

Reference has already been made to the technical difficulties which are well-nigh insuperable, and as the skilled reader, who has reason to suspect a position, looks first for these, we had best follow the precedent.

This enlargement will make a good start. Here is an important entrance, a way through the house to the hangar behind it. That house determined the north limit of the hangars at this point. We may fairly estimate the height of the bit of field behind it at no less than seven feet, possibly higher; the thick creeper on the roof appears to be not much above it. The path of the kitchen-garden to the left slopes down to the small plot—or should we say slopes up?—and it will be noticed that its north side is terraced. At the base is an imitation hedge—about ten feet wide—and two terraced levels are above that, so that the field is far above its high hedge. This garden has to be on a higher level, because the traffic goes through the hangars under the white screen over the dip, and although six or seven feet of headway will suffice for men going through the house, the terraces have raised the level of the kitchen-garden to perhaps 12 feet or more, for the higher traffic to pass under it.

The surface texture of this modelled Earl's Court scenery on a large scale is excellent as seen from a height. There is no doubt that the German camoufleur has mastered that problem, as well as that of the actinic properties of colour. And his immunity from detection owes much to his chemical knowledge and his faculty for making *ersatz*, but infinitely more to his constructive artistry and patience.

On the right of the house is the path which crosses the whole length of the field erections, and we see it descends towards the level by steps of tone indicating obstacles which no one could surmount without an alpenstock. The whole position reminds one of Phil May's drawing of urchins out for adventure. Mushroom gathering was suggested, and one of the urchins boasted to the others that he was a beggar for climbing. And this is flat Flanders! To the right of this miniature mountain-path we find the mean level, and just a little is seen here of the house with its roof, top awry, of which a detailed enlargement is to be seen in the drawing (page 31).

The houses in the village are firm structures. On this and on no others the tile ridges are indicated. And when we come to examine its cast shadow with care, we shall see that it is nothing but a roof with short hanging sides, for an interval of light comes between the hanging side and the main shadow. It is, in fact, a flimsy erection raised on poles

to give a sense of solidity to the false bottom over which it stands. Above that is a screen that appears to be made of bent metal sheets. There are two others hereabouts, more sham representations of terra firma. In the drawing these screens will be seen in their respective positions, but the main attraction here is the very subtle lumped-up device in the tram-cutting already analysed. We see here, too, how strong contrasts of dark and light flatten in effect the adjacent incidents of tone. That is the function also of the white path.

"Keep everything low" is one of the camouflage instructions found on a German prisoner. Perfectly sound! The lower your highest point, the more gradual your slopes; the greater economy in material; and the absence of tell-tale shadow and of dangerous variations of tone.

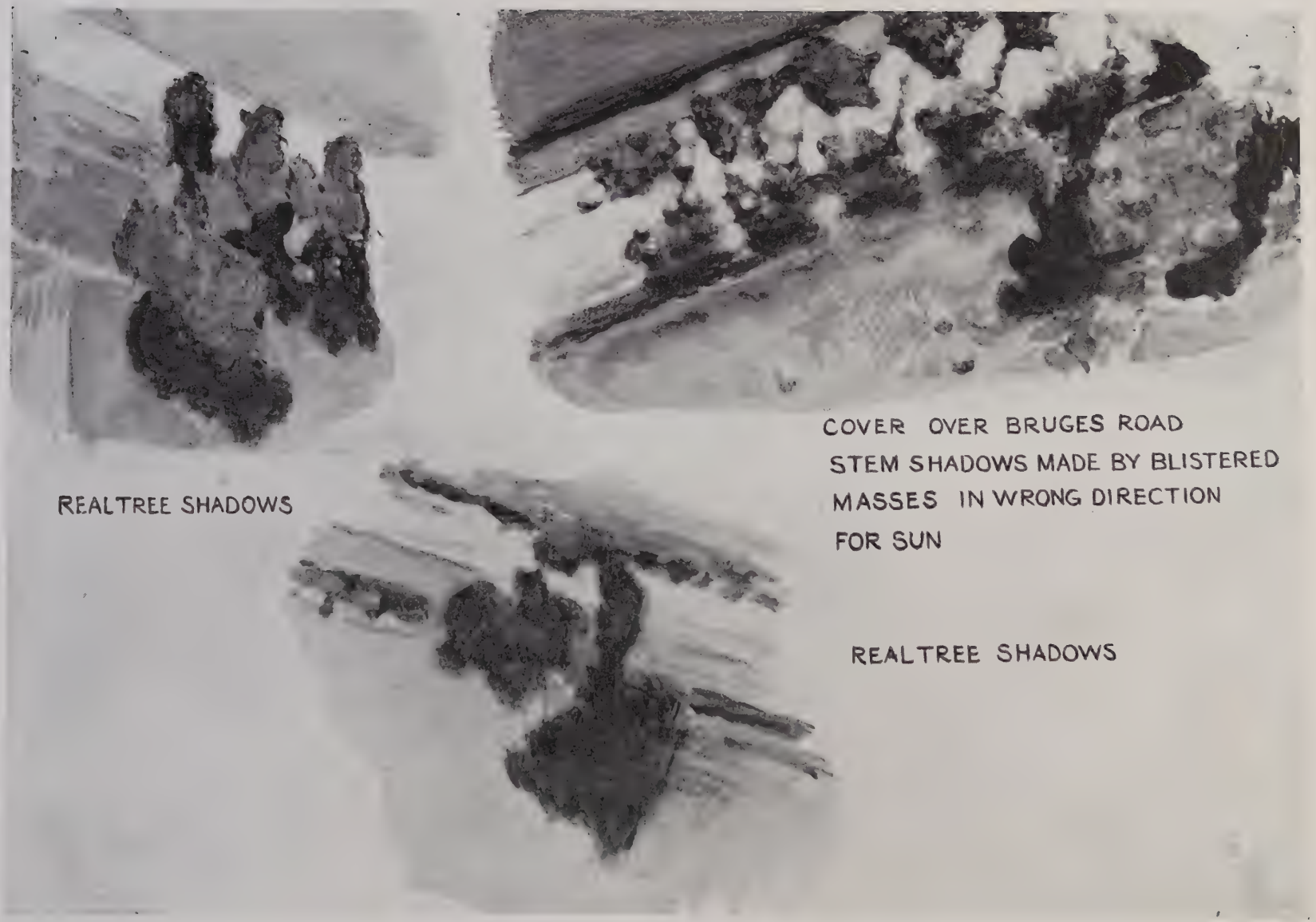
Ten to fifteen degrees added to the natural fall will ensure adequate drainage from the roofs. And if the middle of a big hangar built on these lines can only be used for exercise or to stand upright in, nearly all the rest can be slept under, and that is what most men want to do who are hidden in such positions during the daylight, until the order comes to them to throw their weight, after a short march, into the action which is raging on the nearest front. And, what might be equally effective, to remain in such an ambush and emerge only to get behind, or cut off an unsuspecting and too far advancing foe. In such places also, divisions that are being sent from one sector to another can rest on their journey during the daylight, unseen, unworried, and, what is more important, ignored by the opposing intelligence, as the staging of divisions so hidden would be ignored throughout the war.

CLEVER AVOIDANCE OF SHADOW.

Note the lumped-up white masses in the very sudden bend of the false tram-cutting, designed to flatten in effect the slope of the roof.

THE COVERED-IN BRUGES ROAD.

The arrow points to the four dummy shadows of trees. Note blisters on top of the white road cover.



A COMPARISON OF REAL AND DUMMY TREE SHADOWS.

VI

COVERED ROADS

In the enlarged photograph of the Bruges road and the stream and fields to the south of it, what we see is neither the road (although to the uncritical it is flat) nor the fields nor the stream. The great blistered masses clearly seen through a good glass, over which it would be impossible to drive, should make it quite evident that what we see on the road is artificial. But let us probe the meaning of it all. There is a tubular covering over this length of the road, the rising curve of which checks the shadows of the small trees on its south. So between and slightly above these trees, irregular modelled white shapes curve, letting in light for the traffic on the actual road below. But trees must have their shadows, and these are made in camouflage immediately opposite the real trees. It will be seen that these pretended shadows are painted, with smaller blisters to help the effect, and are themselves sunlit; light which indicates the modelling (contours) of the cover as it curves down to its northern margin.

And these shadows are on the same plane as the trees themselves. The drawing opposite taken from trees on another road in the same photograph, and therefore lighted in the same way, gives an idea of the difference in the quality of shadow, and the tree casting it, and the corresponding levels of the one and the other. We see that a real shadow is one flat tone, but that the imitations are taking light and making shadow. The lower tree in the drawing is seen obliquely, but what lies flat on the ground cannot be so affected. The tree shadow is on what stands for the ground, and it must therefore take the angle of sunlight. This particular shadow is slightly distorted by the fact that it crosses an elevated cover over the road which runs from Leke into the middle of the village.

Blisters

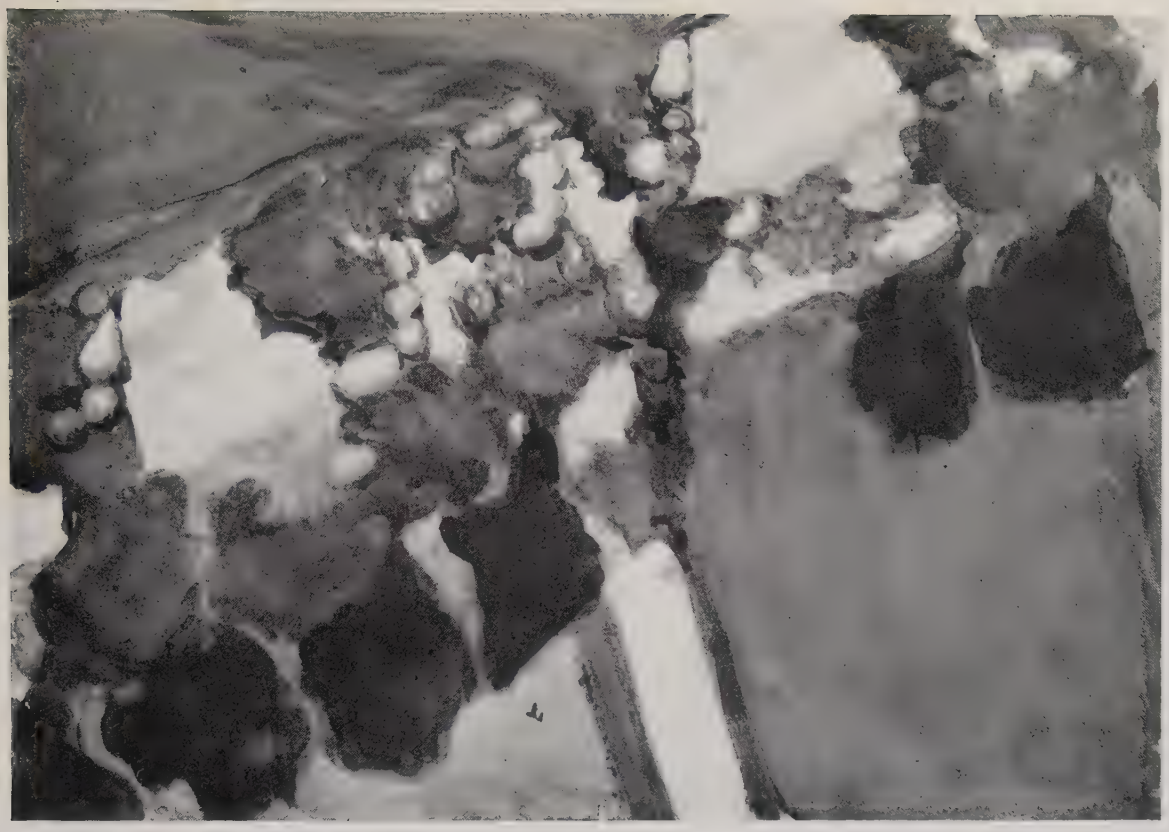
The function of the blisters is to make the shadows of the tree-stems across the road, and to hide, by rising well above them, what would be

incriminating shadows in the wrong place, cast at different hours of the day by the real trees, and by casting shadows themselves, they give some colour to the correctness of the angle of shadow made by the sun at varying hours.

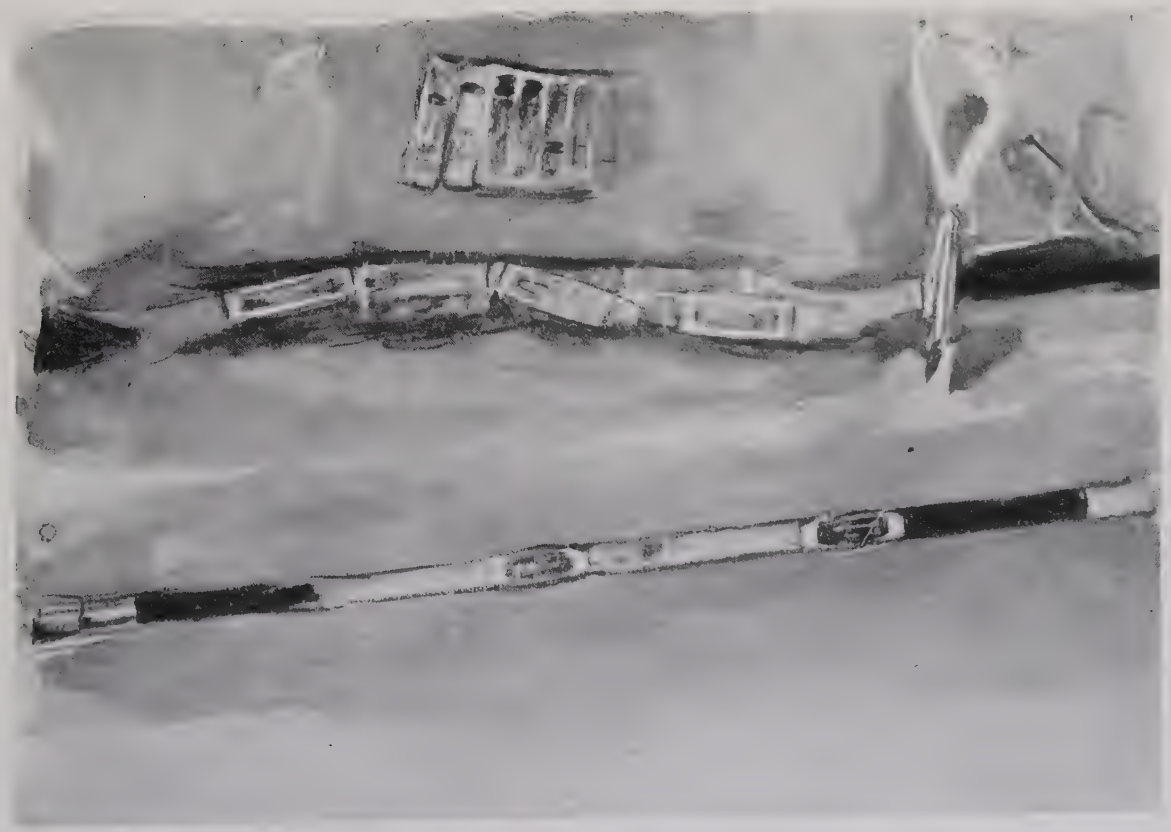
It will be seen that the pretended stem shadows do not fit on to the trees at all, allowing for any obliquity of view. And whereas the sun is now at about 12.30, the stem shadows are at nearer two o'clock, and the tree-stem shadows on flat ground would have to be in a line with those in the drawings. The shadows of the trees themselves are much too far off for midday in summer.

One sees also the half-tone on the side of the cover, coming into full shadow in places nearer the ground. A little to the east there is an obvious large opening on the north side of the cover. These light-affording openings are indications of the positions of turns of the road, or branch turnings. Nearly opposite this one headway is made for lorries to turn on to the fields. The camouflage stream under which they go at this point is by no means flat; it rises and falls most accommodatingly to fit in with traffic facilities. The road cover could not be taken through the village at its full height without checking unduly the shadows demanded of the houses, so the traffic is directed across the fields to the south, by which means the higher vehicles reach the Nieuport road through the field-hangars. And, again, we see headway is made by the north side of the Bruges road, for traffic branching from it to the covered lane that runs north from it, at the east entrance of the village; a camouflage slope is made at this point, to cast a shadow beside the real trees, corresponding in its angle with those of the false tree-stems, and similar artifices are employed elsewhere along the north side of the road to carry off the fraud. This drawing shows the subterfuge resorted to, where a side-lane joins the Bruges road. The blisters used here are drawn in outline, as seen among the foliage real and false.

Note the camouflage a.-a. gun position alongside the road. This affords headway and directing light for traffic leaving the road at this point. And then the long straight drainage-pipe joining up the farm with the stream. There is a whole system of pipes, right angle and otherwise, most of which are in imitation of paths to this pumping-station. The ditches and streams abounding, dammed up where necessary, had to be pumped dry and kept so. We know of another place discovered in the latter days of the war, when the canal running underground was similarly dammed up and pumped dry, for the accommodation and safety of German troops, until they were trapped. There are other pumping-stations which



THE BLISTERS ON THE BRUGES ROAD.
Note the lumped-up mass at the junction.



GLASS FRAMES FILLING UP OPENING.
Similar vegetable glass on the field near by.

PONTOONS JOINED UP WITH BOARDS.
These pontoons are wider across than the stream.

House with no cast shadow
↓

THE AREA BETWEEN THE BRUGES AND LEKE ROADS.
Arrow points to rail-head. Pipes over covered fields in imitation of paths.

will be pointed out in due course. Is it the normal condition of a Flemish village to have large and long pipes lying on the fields, made to imitate accidental paths?

Following the Bruges road into the village, the foliage is curiously massed right across the road where the cover begins to descend. A pipe system joins the cover, on a level with the roof of the house on the south, and the road surface opposite this house might be flown over, certainly could not be driven over. The trees farther on to the west cast their shadows across a lower curve, which should be high enough now to accommodate the passage of men. The kitchen-garden to the south is obviously a pent-house roof with pipes running along its apex; others, converging to a pumping-station farther south, which has apparently plenty to do (see centre of Plate opposite).*

Just above the kitchen-garden are the vegetable glass frames from which those filling up the stream near by were probably taken. They are of exactly the same proportion when measured. A sketch of these we have just seen, page 24.

The kitchen, or nursery garden, is a favourite device of the German camoufleur. An airshed near Brussels was so disguised, and eluded our airmen until through another agency its position was indicated, with directions to visit it when the sun was setting. The long shadow then cast by the high erection revealed its bulk. The German, profiting by this lesson, put up a great airshed at Mons, with the very gradual sloping sides adopted by them for field-hangars, with the result that this was only discovered after the Armistice, not from the air, but when the district was in the hands of our army. The principle of the gradual slope was not known to our readers.

This photograph gives some idea of the nature of the area lying between the Bruges road, Forrenhoff Farm, and the supposed railway. The very black stream is far too dark for any water in sunlight. The railway end of the wide part of it is filled up with the glass frames referred to above.

The narrow strip of stream to the east, north, and south of the railway has in it pontoons joined together with boards, and, as they are wider across than the stream itself, they could not float on it. If the lighter portions of this stream represent sedge and weeds, they certainly end with very formal shapes, very cardboardy in appearance. The shadows of the planks across these show them to be convex. And if this stream is really

* The break throughout the middle of the photograph is due to being doubled up in the airman's pocket.

water, why does it disappear under the railway lines and not show up again, as it would have to? When the attention of perhaps the greatest painter living was drawn to this stream (and it indicates the care and knowledge with which he examined the photograph) he remarked that, with that position of the sun, some light should be found at the bottom of this opening, if it were a vacant space and not water. To test the accuracy of this assertion a model was made. The stream was cut out in a sheet of cardboard, and, when this cardboard was placed near the ground, light could be seen coming through, markedly from the opening running north and south. But when the cardboard was raised a little, and the openings north and south filled in, as they are by the glass frames and pontoons, no light was to be seen on the ground when the model was looked at obliquely as one sees it in the photograph. One learnt by this, not only why part of this opening was filled in, but also the approximate height of the camouflage fields on either side, from the ground, no doubt enabling lorries and big guns to be parked here if needed. Where there is water, either real or false, in this photograph it is several tones lighter than the grass fields; and a plank or bridge crossing it casts a definite shadow on it; here the shadow is so deep throughout the opening, that nothing crossing it makes any difference. A shadow cannot be cast on shadow.

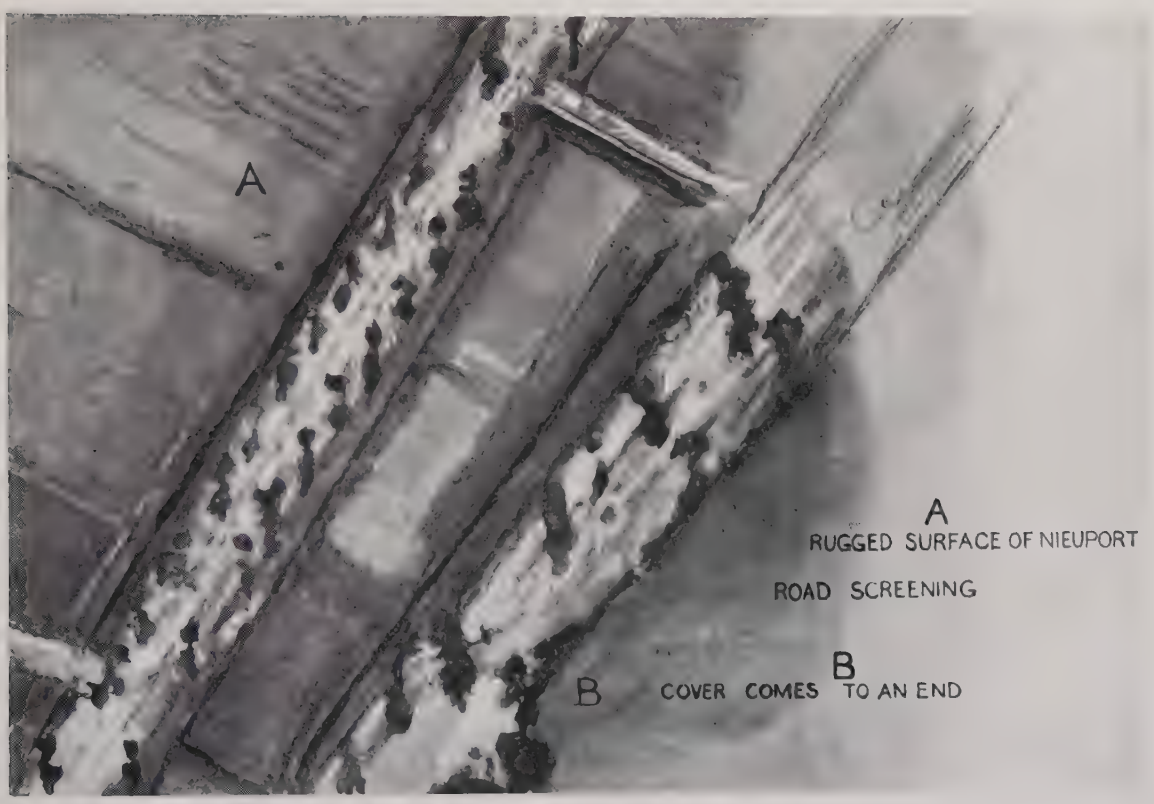
The problem of light and ventilation is perhaps the most serious one the German camoufleur has to contend with, and this is one way (a dangerous one) that he has resorted to. He probably had not then learnt the use of wire-gauze or scrim, which would have helped him considerably here. But the hard cover method has many points in its favour. On it, it should be possible to strew quick-growing seeds, to help its texture and make those seasonal changes that might be expected; which by other means also a few men stationed at such a centre as this could accomplish bit by bit.

Samples of other roads.

(1) Throughout the greater length of the Nieuport road, parts of which are seen in the drawing opposite, the tubular covering is obvious. Its furrowed surface is frankly impossible. A tank would be needed to surmount such obstacles. Some of the trees are nothing but black holes in the apex of the cover; and the lane running into it at right angles joins the main road almost at its apex. The trees (?) on the north side are far too near the middle of the hard highway. The camoufleur hopes that you will take the shadow side of the white covering material over the road for a grass run north of the trees (?), but there is a distinct difference of quality of the tone between the grass run on the south, and this shadow side

THE TUNNEL COVER OVER A LIGHT RAILWAY.

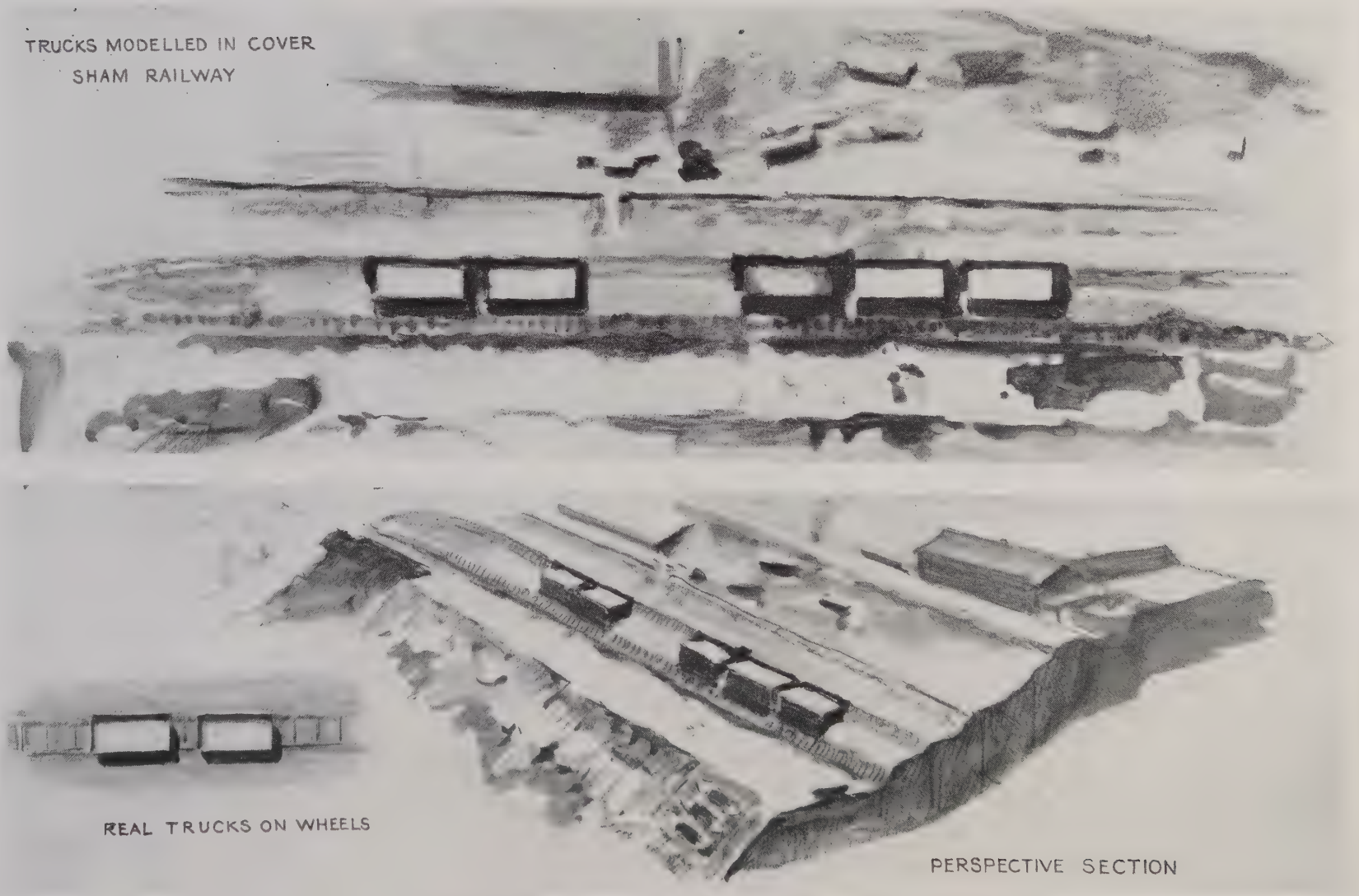
Note the white mass across the imitation lines.



CAMOUFLAGED TUNNEL-COVERING OVER THE NIEUPORT ROAD.

The surface of a real road in a Flemish village.

REAL AND ARTIFICIAL ROAD SURFACES COMPARED.



THE DUMMY RAIL-HEAD AND DUMP IN THE MIDDLE OF THE VILLAGE UNDER WHICH THE TRAFFIC PASSES.

of the cover on the north which a glance will satisfy. If all was flat there could be no difference. Little wonder that no traffic was ever reported on this main artery to the Flanders front; it certainly could not go along the top that is exposed to view. B is the road cover coming to an end towards the village. One sees from this point how the cover rises and reaches its full height where it meets the top of the hangar, up the sides of which the sunk tramway takes its course; and also the differences between the surface of the short length of real road near the village and the rest.

To enable one to realise the appearance of the surface of a high-road in Flanders the photograph under them should be useful, to compare with the drawings of the Nieuport road. Also there are several lorries in the village as well as people about, which one would expect in a place on a main road, about the same distance from our front as St. Pierre Capelle was from that of the Germans.

The covered lane north of the Bruges road with its right angle cracks and its circular dip is hard to swallow. By the map it joins the Bruges road again a kilometre and a half farther east, and should be useful to divert the traffic at this very busy centre. The Germans were determined that nothing should be seen moving. The activities of the place are all hermetically sealed from view.

There is an imitation of lines and sleepers covering the light railway that runs from alongside the Leke road, under the dump-head in the main street of the village. This low tunnelling is lighted up on the south side and has its shadow on the north, as well-curved surfaces should have. The camouflage track is careless, the lines are never parallel, and the gauge is capricious, just as they are in their continuation towards the village. But why was that white excrescence left across the lines? Under it there is an opening which lights up the tunnel (see page 26, top drawing).

The railway trucks make a most interesting camouflage study. To understand the aerial view of them, and on what they stand, it would be as well to refer first to the perspective section under the drawing of the vertical view.

It will be seen that from the cover over the fields to the north there is a rising in tiers. What are supposed to represent the rails are on an incline, and very roughly modelled, and we go up and up—for each bar of tone represents a rise, just as with a flight of steps—till we get to the Leke road cover. There is a tier above and immediately at the side of the trucks, which are half constructed, half modelled in the general covering

material, so that light goes through the interval left between the top flat, which answers for the floor of the truck, and the overhanging, irregularly edged cover to their south. All this is very clever, but when seen through very incriminating. It is a minor matter now to remark that the trucks are between, not on the lines, and those that are supposed to be on them are too far to the north of their rails. As in every other similar instance, wheels are dispensed with, but to the unknowing these trucks give a sense of solidity to the covering, and of warlike activity to the place.

The dumps of timber, pontoons, and so on, lying on the sloping embankment, which one might naturally conclude had been conveyed on these rails, are simply modelled fudge, put where they are to make the slope appear flat ground, and to let in light, like the other incidents above the trucks.

The medium in which they are modelled must partake of some of the qualities of plaster of Paris, malleable when moist and hardened by exposure. Of this the stooks, blisters, and contoured surfaces generally seem to have been modelled, perhaps over wire-netting. This is a composition we shall recognise again and again in the positions analysed.

The cover of the Leke road, with its pretty, neat, drum-like bushes on either flank, is divided into three tones. The white should stand for the road proper, but it has a haystack well across it and it happens to be an inclined plane about parallel with the source of light. The top flat with ts marked ridge joint, that should tell white, is lower in tone, the other leaning side slopes down to the north a little more acutely. Just faint attempts are made to show what look like horsemen careering over this screen, and one can follow this cover, in a slightly different form of modelling, into the middle of the village with the wheelless trucks, etc., put up against its very sloping side. Where the road cover comes down to the level there is a curved top to the hangar by its side, which ensures equality in the width of the shadow it casts on the descending plane. Had that erection a straight roof the shadow cast on to the gradient would have been anything but parallel to the roof. This is a remarkable evidence of care and thought.

Plate 20

A PUMPING STATION, FRAUE FORENHOFF FARM

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To face page 29

VII

ORIENTATION

THE three drawings which follow here are illustrations of the advantages of a correct orientation. The village runs, in the main, east and west, so for all practical camouflage purposes there is a constant shadow on the north, except for the airman who gets up very early or lands at dusk in midsummer. The south sides of the houses correspondingly are in sunlight all day. You can raise obstacles on the north front of houses only to a limited extent, or you distort or contract the expected cast shadow, with considerable risk of being found out; but you could leave your raised unfinished work facing south with far less danger of its being detected. Or you can make a lean-to against the south side of a roof, and cover up the whole yard without any but an expert being the wiser, if you use a little skill. But you must be careful that the airman does not take an oblique view of your camouflage, if other houses in the same line or parallel are left to expose their whitewashed sides, windows, and doors, to mark the contrast with what you have shut off from view by your lean-to. In every case it is not wise to interfere with the rigid outline of your roof at the eaves.

We have an illustration of great daring in this direction at the Fraue Forenhoff Farm. Part of the white sides of two of the buildings facing south are well seen, and the edges of the roofs are clear-cut in this somewhat oblique view, but the long barn shows no white side, and something attached to the edge of the roof has confused its outline; so suspicion is aroused. Further logical investigations assure the camoufleur who knows the game that not only is there a lean-to, but that the whole enceinte grass plot included, is many feet above legitimate terra-firma, and the truck nicely bolstered up from below, that was going to make the whole thing look so real, is casting its northern shadow almost on to the roof.

The buildings are not seen to their full height; at least six feet of them is hidden, which, in such a foreshortened view, would be represented by the thickness of a line only.

The black hole in the water to the south of the farm-house, as dark in

tone as the stream already dealt with, and as another dark hole in the ground about thirty yards to the south-east, lets in light and air to the covered-in area around it. It calls for careful examination.

If we compare the length of the shadows cast by the gate-posts at A with that of the barn on the other side of the path (which is ridiculously short) on the one hand, and that cast by the truck, which if on wheels would be higher than a gate-post, on the other, we shall see that these posts are on a sloping surface, and, as the water reaches the top of this sloping road, it must be running uphill.

It is intended to represent a passage of clear water surrounded by sedge—the only clear passage in the whole moat which encircles this pumping-station ; but on the water itself there rests a solid mass, casting shadows, not cork. In the imitation of the moat, north of the farm, the water, terraced and in lumps, stands well above the field containing it. These lumps cast their shadow on the supposed field and support the head of the straight pipe that runs from the farm to the ditch alongside the Bruges road. This pipe shows a right-angle joint on its way to a pumping-station, on one side of the farm, and a clear diagonal section on the other (B C). At the east side of the farm building the cover rises to a level with the trees, and the straight pipe runs at the side of a hangar that covers up the field between the farm and the main road. The horse-run seen here has never had a horse on it, for there is no path leading to it from any point. Its south-east corner curls across the base of the hangar to give it the sense of solid ground.

CAMOUFLAGE BROUGHT DOWN FROM THE ROOFS OF THE CENTRAL HOUSES

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Now we may skip over and examine the backs of the houses at the west of the main street, and see another example of the advantage taken of the southern aspect. Here we have a lean-to similar to that at Forenhoff Farm, brought down from the roofs of about six of the centre houses of the group.

The white sides and the windows are exposed of the houses at either end ; these are hidden in the case of the houses between them, except at two points, where bits of white wall peep between the hanging cloths. By the side of the first house in the village (one of this group) extreme left, there is a white-topped tunnel, that comes up from the road-level to the eaves of its annex.

These covered ways between the houses and the field-hangars afford convenient means of ingress and are to be seen at several points behind the village.

On the road in front of these houses the dummy horseman is seen. His horse is lighted by the sun and casts its shadow on the ground, as all solid objects in sunlight must ; but in front of him (and this is how we know he is a dummy) there is a big black hole, intended to represent three horses, for three black equine heads and necks project from the black hole, which is said to be their bodies. There is no light in this mass of shadow, cut in a canopy higher than the rest of the road.

That black hole indicates the house through which men could pass, for behind it there is a raised covering which can be followed in its course across the little bridge. A hole beside the double-roofed house with camouflaged garden has a white cross over it, and, by the directing light that is let into it, the way is shown to the cottage with the white flap, one of the main entrances to the group of field-hangars.

In the photograph of houses and their back gardens in a village in our lines (see page 26) there is no difficulty in realising the height of the roofs from the ground. The normal difference of tone between a plane and one above it are as marked in an aerial photograph as in any other. It should be compared with the last drawing.

Traffic Routes

Many references have been made to the traffic routes to, from, and through this village, and to some of the indications which have led to the conclusions arrived at, and which have materially helped in a logical piecing together of the otherwise scattered evidences.

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It was quite obvious that the high road-covers on the Bruges-Nieuport road came gradually to an end on nearing the village. Then how did the traffic from the west get to the Nieuport front? This puzzled me for a long time. Not until many unsolved mysteries gave up their secrets was it evident that the traffic left the Bruges road before reaching the village, to take a cross-country line behind it and join the Nieuport road from under the field-hangars. Some of the covered roads are probably lighted electrically, although there is a succession of blank openings seen along the top of some sections of them. Those seen at the side of the Bruges road appear rather to be directing lights, and these directing lights are of considerable assistance to the reader. They are the "two and two" which come together with decisive results. We see them, for instance, where the traffic leaves the Bruges road to cross the fields at the a.a. gun emplacement; at the black hole in the moat; again at Forenhoff Farm. Then we get the black opening of the pretended stream with the pontoons on it, as we proceed south, towards the Leke road. Along this covered route we have the construction evidences showing that it is used for the higher traffic, on its way to the Nieuport road.

But what about the lower traffic and the passage of men? We get similar guiding lights through the village itself, by means of an opening in the Bruges road just where it curves; to the south, another smaller one, where this turn of the Bruges road meets the main street; and then the three-horse black opening; after which the black hole with the white cross on it finally directs to the cottage, one of the main entrances to the system of field-hangars to its south.

There are many others, but always just at the points where any designer of such a system of camouflage would have to place them, and they are as illuminating to the reader of the photograph as they were to the troops whom they guided to their destination.

This drawing represents the engine with radiating pipes among the trees behind the church. More drainage. The stream runs by this field. And on the next another pumping engine camouflaged all over (B) at right-hand corner of the photograph, similar to one on the false aerodrome at Sparapellehoek; also a staging camp for divisions of men. Those are the main points in this extraordinary work of military art.

Enough has been seen to convince one of the importance attached by the German to the concealment of men and activities, and they reveal methods and mentality, which should serve as a key to the interpretation of other photographs of the kind.

A PUMPING ENGINE CAMOUFLAGED. PIPES RADIATING FROM AN ENGINE.

A position such as St. Pierre Capelle may have taken months to bring to such perfection, for a long war was to succeed the first great German failure, throughout which this place would be utilised to the full; and, though its camouflage must have been standing before the summer of 1917, there is no sign of damage done to it, and it was well within the range of our guns.

We first hear of the bombing of the hangars in it in March 1918, after the drawings referred to had been sent to the quarter which dealt with such objectives, and by then the greater part of the camouflage material had been removed, to be used as screening farther south. For the Germans having after the Russian *débâcle* the means to renew the offensive on the Western front, planned to reach the Channel Ports by the way of Mount Kemmel, and were eventually forced to evacuate Flanders when the pressure on their left flank threatened their main communications between Verdun and Luxemburg.

It was then that this village was utterly destroyed by the Germans themselves. Why? For the next villages were intact and peaceful when visited by *The Times* correspondent. The Germans evidently look upon this strategic camouflage as a secret still, seeing that we have consistently ignored it, and would leave no evidences of it that they could possibly destroy before their departure.

It will be remembered that they carefully forgot to bring, in their surrendered warships, the range-finders and other instruments, the secrets of which they hope also to keep for another occasion.

The comparison of a series of photographs taken at a later date than this one of 1917, would have shown signs of the dismantling of the fields. The Germans would not leave to rot material needed elsewhere. At a time when there was great uncertainty and much speculation as to exactly when and where the great offensive would take place, these dismantlings would, by a process of elimination, have helped, with other intelligence, in reducing the possible fronts on which signs of that offensive might be looked for.

This at least is a fair assumption, and indicates how much other useful information may have been missed by ignoring the enemy's camouflage methods. In spite of the invaluable work done by some sections of the "Intelligence," no one will pretend that it was altogether infallible. No one can know what he has missed. Even recorded history is but a mosaic of which always more than half the tesseræ are missing or obscured.

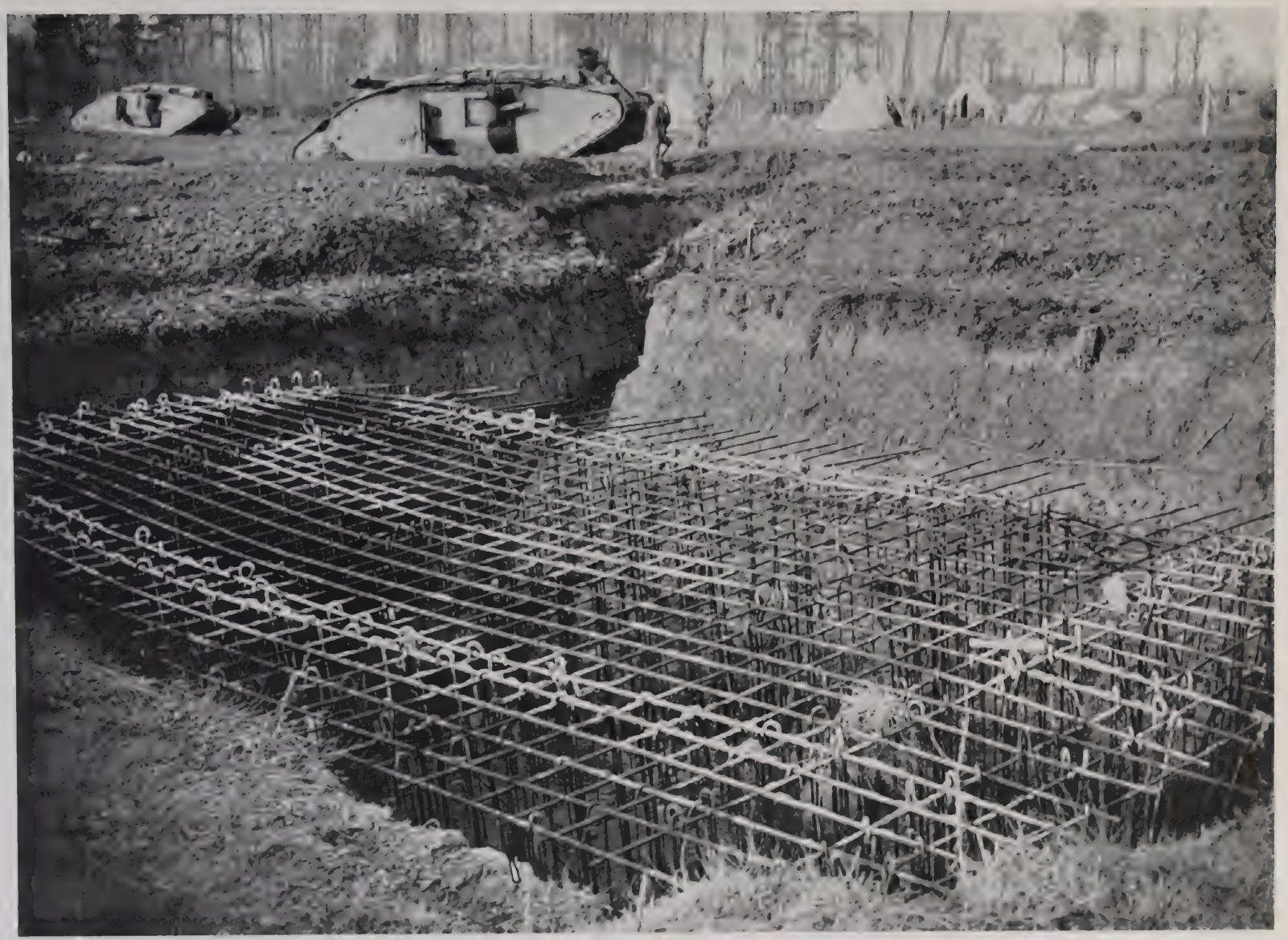
VIII

Field-coverings in the Making

The chief objections raised, when the evidence of German methods was discussed, were the possibility of making such constructions unobserved, the question of windage, of the quantity of material, of transport, etc., etc. As a camoufleur, one may say that none of the difficulties seem in the least insuperable. The constructive methods and precautions pursued are fairly clear to any one who can read the photographs of German camouflage positions intelligently. And the type of camouflage could be reproduced, by a resourceful artist, who had the requisite assistance and material at his disposal. The Germans are never deterred by the immensity of their task: they revel in the colossal. An airshed something like a kilometre long that revolves; the immense Zeppelins themselves, of which they had the first conception; the tubular dock at Kiel with perhaps a landscape over it, may be cited as examples of their constructive capacity. The huge airsheds put up in Belgium, some still standing, within easy reach of our airmen in Flanders and France, prove that the risk of being discovered or prevented from completing work once begun, is not so very great, or at least was not when they were constructed.

The difficulties attending the making of a series of low hangars in imitation of the landscape under them, are incomparably less than those involved in the constructions just cited, or in the covering of roads, or any of the problems analysed in the St. Pierre Capelle area. We must remember that for weeks, even months together, atmospheric conditions are not very favourable for the taking of photographs in which detail is clear, from the height at which they must be procured. And even when they are favourable a large amount of preparatory work can be done and left standing that will tell no tales.

The photograph of the preparation for a concrete work in a quarry will serve to illustrate this point. It must be borne in mind that these bars were evidently made in the million, and might well serve (among other materials such as could be got from the woods and forests near or at hand) as very solid supports for any covering required.



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PREPARATION FOR A STRONG POINT IN A QUARRY. EXCELLENT MATERIAL FOR THE FRAMEWORK OF CAMOUFLAGE ROOFING.

PLATE 23.

In quite low, good, sunny photographs the stems of slender trees are often not recorded; a frame-work as complicated as the one in this photograph, taken from any considerable height, might only just affect the general tone of the field on which it is left standing; and it is highly

FIG. 5.

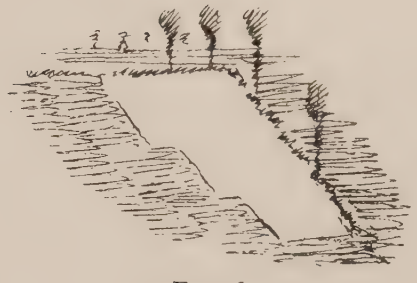


FIG. 6.

improbable that it would signify much, if seen, to the reader who was not well versed in German camouflage methods. Again, the whole of the covering material laid ready on the field (fig. 5) would only look like plough or vegetation according to its surface texture; or like cut crops (fig. 6) if disposed accordingly, until the whole field was covered. These phenomena should give an idea how, with carefully planned organisation, work of the kind we are discussing could be carried out without much fear of detection. In some cases, all supports could be laid flat on the fields in their destined places, preparations being made in each instance for fixing uprights in the ground and cross-bars or wires in their respective settings. Then the covering material could be placed over them, its pieces joined up in manageable sections and appropriately camouflaged, so

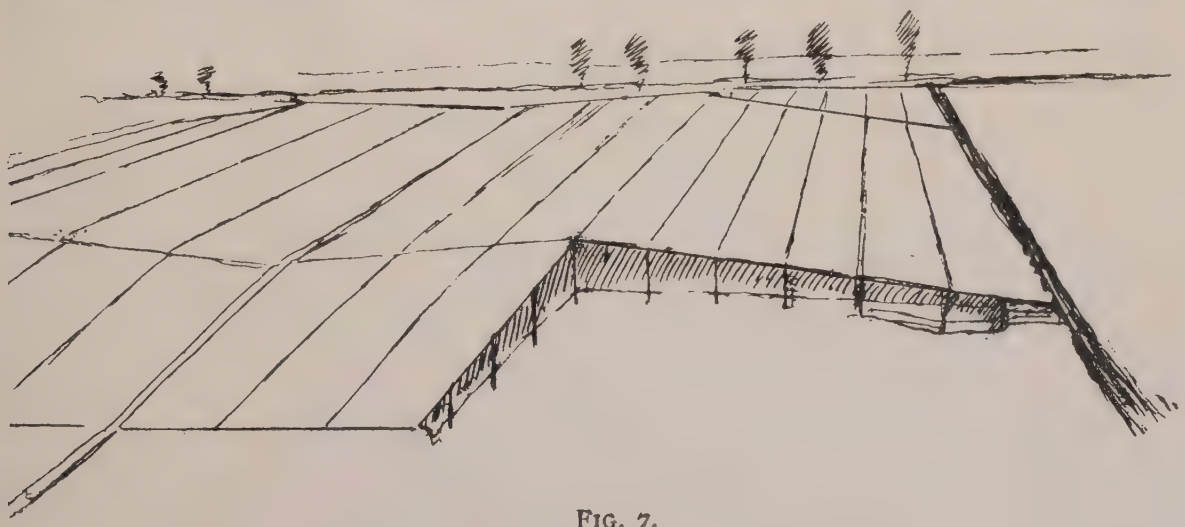


FIG. 7.

that when conditions were favourable the whole structure could be raised within a few hours. If the side of a hangar has to be left open until an adjoining one can start, its roof-lengths, placed temporarily against the gaping side, could be sloped at the requisite wide angle. As these erections are low, the material for a large part of them could be conveniently man-handled.

Transport

In a photograph of one of the camouflaged German camps in a ploughed field, one hundred and twenty yards wide, thirty furrows can be counted; that made the furrows four yards apart. And in another field pieces of corresponding width are seen lying on the ground apparently being joined up. This effect the reader takes for cut crops.

Thirty hundred-yard lengths, four yards wide, would cover a field over a hundred yards square. Enough to shelter a brigade. If the length of each covering piece was eight yards—a convenient length for transport—thirteen would suffice for more than a hundred yards; so that about four hundred pieces four yards by eight, would be a liberal estimate for the quantity of covering material required. A specially constructed lorry could contain one hundred sheets, then four lorries could carry all the covering, and perhaps half that number its supports. That is six lorry-loads.

Material

As to the covering material actually used one can only speculate. The Germans have employed very largely for their ordinary camouflage an open-textured "canvas" made of wood fibre. Here a non-porous, rigid, and no doubt light composition has been evolved to meet the special requirements, in which, possibly, wood pulp or fibre forms a part. In a captured German dump 130,000 tons of wood fibre was part of the booty taken. It looks very much as though some of the composition used could be rendered malleable by steaming. Much time and labour might be saved by us, if fragments of the different materials used by the Germans could be collected and analysed; they must have spent considerable pains in evolving the most suitable compositions.

Windage

As far as windage is concerned, low spread-out erections on a firm frame-work would hardly need any further support, but the higher

individual hangars as well as covering over roads might in exposed places need guy-ropes or wires. The arcaded covering over the Queant road, still standing after the retreat, was described as being supported by guys, which would not be seen in a photograph. That covering was made of wire netting interlaced with strips of canvas of the kind referred to above, but the covering of roads at St. Pierre Capelle and others mentioned in these notes is of a far more opaque material.

The ridge and furrow covering largely used in one known position, and doubtless in others, simplifies the drainage difficulty, the rain-water running down the furrowed fall, the ridge harbouring no water on the more undulating ground.

Many of the actual fields seem to have been ploughed with furrows wide apart, so that the contrast between the real and the artificial might not be too marked.

Also the ground pictures devised in areas where erections are being put up have considerably helped to allay suspicion. They, no doubt, have put everybody off the scent. To most people it is the vastness of the work which appears incredible, yet if we reflect on the many miles of hutting behind our lines, and of the enormous acreage of solid buildings put up in the course of a year in England for war purposes, which represent infinitely more material and labour than this German screening, made without walls, and which is simply a roofing, we shall see that it is really artistry and organisation, not material difficulties, which excite this incredulity.

IX

LEUGENBOOM WOOD

We have in this picture an illustration of the German method of concealing a "Bertha" among trees; and the cunning and industry exhibited are extraordinary. There are abnormalities throughout the picture, enough to engage attention and thought for many hours in weighing possibilities against probabilities; and some of them will be noted here.

In the south-east corner of the wood is the wreck of what, from its exposed position, was in all probability a decoy-gun emplacement. This has received the determined attention of our bombers, whose handiwork can be seen, short, over, and on the spot. From this emplacement the faint indications of a disused tram-track have been camouflaged; and this camouflage is very like a ground-picture. To the right of this there is another obvious dummy, with a too-well-marked tram-track, which makes a junction with the first-mentioned one, and branching from it two tram-tracks are taken across the ploughed land, and are therefore less clearly marked on those light fields; but no lines can be discerned on any of these, although what look like real ones are clearly seen on the road which runs along the northern extremity of the wood. There are trucks or imitations at the junctions of both branches, which might be taken along the fainter tracks; but they are heading for the dummy gun.

The two sets of lines converge at the edge of the wood, and one of them would make almost a bee-line north-west through it, to a very suspicious position, just above the north marking arrow.

The decoy-gun which is intact gave a sense of reality to the one which was bombed. The Germans had a habit of multiplying their dummies with this object; and they satisfied both the sound-range finders on the one hand, and the searchers on the other. And, as this wood was enveloped in a smoke-barrage when the real gun was fired, the simultaneous dummy flashes made would be confused with the real.

In spite of the destruction of the first emplacement, the "Bertha" continued to shell Hazebrouk and Dunkirk alternately; and in this August photograph of 1917 there are no signs of our bombing at the north end of the wood.

GUN CONCEALED IN A WOOD.

Then we come across the suspicious position. There, there is a dark ring, partly in the shadow of the encircling trees, with white paths curving around it, which are again seen to branch east and west on approaching the road which runs along the north of the wood. Below the arrow-shaft there is a very symmetrically rounded tree, and, to the left of that, a white mass apparently covered with bush stuff, and alongside it a camouflaged tree, which on close examination will be seen to be made up of our old friends the blisters. Indeed, it is very like a bunch of berries ; its surface is a polished one, totally unlike the texture of the real trees as photographed. These are, at least, evidence that these two positions are elaborately camouflaged and well hidden, and sufficiently far from the obvious decoy-guns not to suffer by accident.

At the time of year when this photograph was taken, paths among trees in full leaf are not very marked. However, we see those around the dark ring, but what is very curious in those circumstances, is the fact that no track is seen to lead through the wood in continuation of the road which runs from south to north through the middle of it, or on either of the two cross-roads which divide up the wood into three parts.

Later in the autumn and winter those roads would show up clearly, and care has been taken to guard against such white lines leading the eye to the actual gun. It will be noticed that each tree in the wood casts its individual shadow on the ground, but along the course of this central north-south road there are no individual tree-shadows ; and, in examining that part of it just above the destroyed emplacement, there is a collective tone, which the sun just past the meridian would make on the eastern side of a covered way, camouflaged with bush-stuff—a way which in all probability leads towards the real position ; for this cover appears to stop short in the neighbourhood of the two elaborately camouflaged spots.

This is of the essence of the German method. We have evidently always looked for tracks. The Germans either tunnelled them over or they were concealed under the universal covering they made for the hiding of men, dumps, and, where possible, guns.

An account was given in the *Temps* of the finding of the emplacement of the Paris-shelling "Bertha" untouched, while the dummy near by had been heavily bombed. We may be sure that there was nothing for which a keener search was made than for this gun whose shells reached the capital, and the readers must have exhausted all their resources in trying to locate it. Such an instance was the supreme test of the degree of knowledge and capacity attained, or lacking.

X

SPARAPPELHOEK

At the beginning of these notes a few examples of the abounding ground-pictures in the photographs of this area were given, and it will be noticed particularly in the July photograph that a comparatively restricted area of white denuded earth is shown in all of them, just as it were, where the light of the sun would fall on one plane; sometimes along a ridge. But attention is called here to the central area in process of construction, where several hundred yards square are to the uninitiated, under the plough, and tell white. Here it is possible to count the furrows; the narrowest of them give thirty to about one hundred and twenty yards, that is, they are four yards apart, with no traverses, or any signs of the turning plough.

The whole area is, on the 8th of July 1917, in the rough; a long tunnel stands up in the middle of the lane which crosses the aerodrome area. Its shadow is seen, not only to the north of it, but at its eastern end, cast on to the lane.

I would like my readers to take the trouble to compare the July photo with that taken in August. No doubt many curious things will strike them, but let us begin with the one of which the drawing here given is an enlargement. In July we see a big reservoir on the ground several feet below the level of the covered lane, which lane is uniform in width throughout its length; but the ends of the furrows are, judging by the shadows they cast on it, raised still above it, and *en passant* remark the black strip to the left of these ridges.

In August a great pumping-machine similar to the one at St. Pierre Capelle (page 32) is over the reservoir and a great pipe runs at right angles to it. The lane at this point has more than doubled its width, and one can clearly detect the ends of the furrows and the blobbed ridges under the cover which has widened the lane, and which now bifurcates at its west end. A path leading from the smaller of the covered ways to the house by the roadside is now seen.

In October we still have the pumping-machine with a deep depression

← Reservoir.

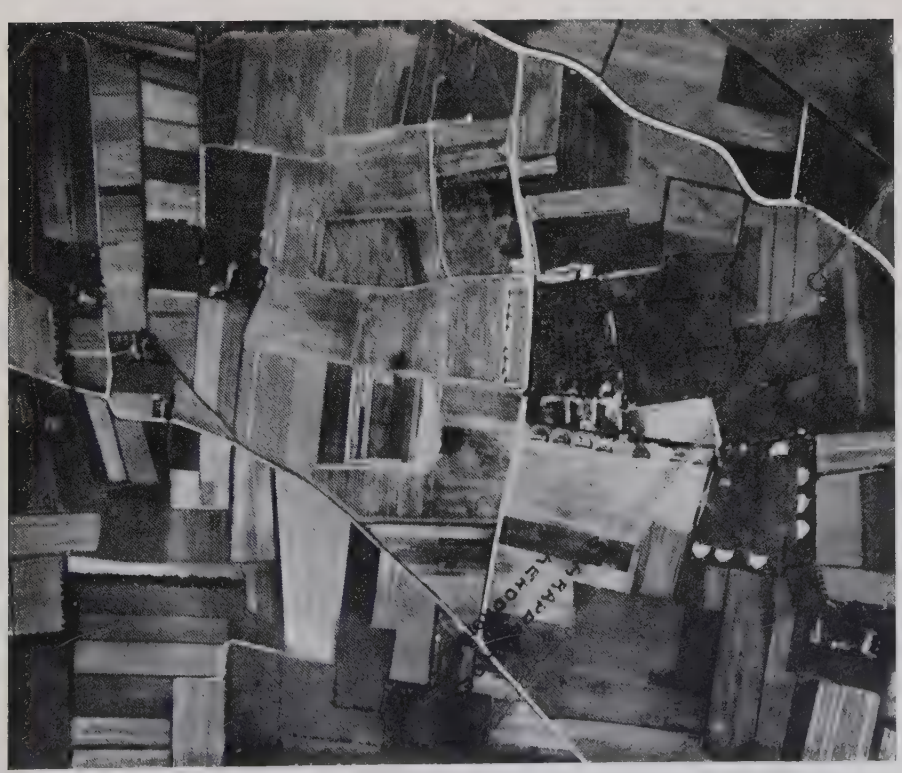
← N.

SPARAPPELHOEK.

The white area in the picture in process of construction.

This quarter of the picture.

↓ ↓



← Engine on field.

SPARAPPELHOEK.

The same area completed.

THE WATER SUPPLY AT SPARAPPELHOEK COVERED CAMP.

in a line with the lane proper. Whereas in July no clear-cut pipes are placed between the great erections, when the pumping apparatus is put up in August, the neat pipes are seen leading from the reservoir around these erections, to convey the necessary water, and some no doubt to carry away the rain-water from the roofs ; for the pumping-station is placed on the highest ground by the map at a 39-metre contour line, this area descending to 33 metres where probably the hangars end. And the descent continues to the river about a kilometre farther south.

Where in the July photo we see the very dark strip (in the drawing), in August there are three white ridges, with eight papier-maché aeroplanes in flight formation on them, very roughly modelled. They are certainly never meant to fly, nor, if they were real, would it be possible to rise or land on the wide furrows which are in front of them.

Curiously, in the October photo, in spite of the fact that the whole area is toned, either chemically or by the growth of quick-growing seeds, these three ridges, minus the aeroplanes, remain in all their virgin whiteness entirely indifferent to what has been going on around them. This was careless. They were so easy to tone.

Remark the doubled end of the great tubes that curve over the big erection, in the angle made by the lane and the cross-lane to its east ; and the material being formed up like abbreviated plough to the north-east of these hangars, and a dozen other curiosities which condemn these few hundred yards square.

There is one important factor for future guidance that should be remarked upon. In the earlier maps the central lane running east and west is practically straight. Now we see a distinct bend in it which has been copied in the later maps. These bends mark the contours of the erections raised over it.

If we wish to play into an enemy's hands, we shall continue the habit of changing the maps, which is often the only use made of newly arrived photographs. It is all very well to mark changes in fighting areas, but here was good ground for suspicion which might have been turned to account. We are certainly not thorough.

The Aerodrome Paraphernalia and other Points

Most of the erections are made of material modelled in imitation of plough, and the fields around are evidently really ploughed in a wide fashion, so that this method should appear normal. Let us remember that at Aertryke, a few hundred yards away, there is a real active aerodrome

after August; real air-sheds, real planes, a machine-gun-testing range, adequate accommodation for the personnel in its immediate vicinity, paths across the fields, and every other indication of actual aerial activity.

Over this great staging camp, what do we see?

Firstly seven white T hangars in an enclosed field. Dummies, intended to be taken as such. No planes, no huts, nothing besides.

In the next field seven T hangars camouflaged in the suicidal conventional method adopted by us and the Allies.

We know what the Germans thought of that, by the tanks we captured from them—constructed by the way, on sound camouflage principles, insomuch that there was no black square of shadow under their bellies, nor rectangular excrescences all over them, to announce their arrival from a distance. Throughout their painful experience the Germans had learnt to detect a tank also by the black outlined conventional pattern with which we spoilt our first designs. They have taken good care not to repeat that folly in their own. They knew the error of it. But when they do adopt this convention we know it is to make us believe that the object so treated is of military importance—a perfectly logical deduction, which the amateurs directing our methods never seemed capable of realising.

These hangars under discussion are so treated to make us believe they are the real thing. Behind them are some suspicious huts of various sizes. This is the accommodation for the personnel. Four hundred yards to the south-west, alongside the covered-in road, are ten well-camouflaged T hangars backed by bushes or low trees, and toned dark enough to make them difficult to distinguish from the vegetation around, making in all twenty-four hangars, which would mean a very big staff of mechanics and airmen. One naturally asks, "Where are they?" Echo answers, "Where?"

One of these dark T hangars at the south end of the row is obviously on a sloping plane, a queer position for its purpose. But mark the mentality and the industry of the German, who gives you three sets of dummies to distract from the real centre of activity on the one hand, and to mislead as to the real purpose of the area he is covering in on the other. Apart from this there are other lessons to be learnt.

In the neighbourhood of a real aerodrome, dummies are a necessity to account for the inevitable aerial activity; but they must be logical, and there must appear to be adequate accommodation for the personnel, and every other sign of the real thing in use.

Secondly, if we wish to attract attention to anything bigger than a

gun or aeroplane, we shall continue to use the conventional painting as a gratuitous advertisement.

So much was this useless method in vogue, that when a subaltern wisely and effectively used growing material at hand for disguising purposes, his Colonel was extremely annoyed. He had indented for paint, and he meant to use it, like the others. There are other less harmless incidents recorded, where art conflicted with the prevailing prejudice in favour of the spick-and-span, over which it is wise to draw a veil.

Again, the sense of proportion is altogether lacking, if hangars or batteries are camouflaged at all, while white paths or other signs of abnormal activity lead the eye straight to the objective for which the airman will be on the look-out.

That is one of the advantages of the more completely thought out system of the Germans; everything is covered up so that nothing of the sort that must necessarily be recorded on the ground is left exposed to all watching eyes above. These questions need, as does the whole science of camouflage and the reading of it, to be dealt with, not by first-comers, but by men whose training and temperament fit them to deal with a subject as difficult and abstruse as is the application of art to war and the discovery of its application on the other side.

XI

POSITION EFFECTIVELY CAMOUFLAGED BY THE GERMANS BETWEEN APRIL AND MAY 1918 DURING THEIR GREAT OFFENSIVE ON THE MORLANCOURT-VILLERS-BRETTONEAUX ROAD

Of this position there are two photographs at hand taken on the 10th and 16th May respectively. The ground-pictures in this have already been dealt with. Now we come to something far more serious.

On the right side of the central road in the photograph running north, there are three great structures, camouflaged in the sense that they curve down on all sides and that on two of them there are great white screens that cast their deep shadows, and so make the strong black-and-white contrasts that have for their object the flattening of the fainter tones made by sloping sides.

The cage-like frame-work of these erections is clearly seen, and the outline and area of shadow to the south and west of the two outer ones made by the sun at 5.30 are identical. And in the other photograph, taken at 11 a.m., the light and shadow of them is reversed. There is no doubt about their being above ground. A divided leaning screen in front of one, a deep sunk trench before the other, and the general nature of the ground preclude the idea that they are used for aircraft. Their particular use one can only guess at, but the main thing is that they are there. How they got there and what difficulties were surmounted in erecting them need not trouble us; there they are, and no doubt there they were, till blown up when retreat was inevitable. The fires seen behind the German lines, and the exploding of dumps hidden under such erections, would efface all signs of them except to an expert who had suspected their existence beforehand; for any one else only the usual debris of war would remain on the ground near where they stood.

The covering of the road running east-west which the central north road joins, is in the 16th May photograph, which takes in an area large enough to include it, seen to come to an end. The steep banks on either side of this road on the top of which the cover is stretched, and

CAMOUFLAGED AREA.

Arrows point to raised cage-like structures on the right of road, and to dummy foundations of houses on the left, 8,000 yards from the Amiens Front. Photographed May 10, 1918, at 5.30 p.m.

AREA ALONGSIDE THE OTHER ROAD IS ARTIFICIAL.

Arrow marks where covered road ends.

Photographed May 15, 11 a.m.

Terraced descent of road cover.

Another method.

Profile and perspective views of covered roads.

HOW ROAD COVERS ARE BROUGHT TO AN END.

on the sides of which at intervals of a few yards there are horseshoe earthworks throughout the greater part of its length, come to an end also just where the shadow falls across the road.

The road itself is narrower than the cover at its widening ending. There is no gradual descent of the bank ; that ends with the descent of the cover. There are no trees anywhere along these roads in the area photographed. In any case, these are not the shadows of trees either in direction, length, or character for 11 a.m. They are irregular terraced descents, and the shadows cast on the road are the counterpart in shape of the raised masses to their right with the sun at 11 a.m. in May. And the idea of a covered road is consistently kept up both in this and the north road which joins it.

A model in plasticine made from the photograph gives the same light-and-shade results at 11 o'clock, and shows us the steep descents from the height of the road-cover to the real road-level.

The road-cover in the photo (page 47) also comes to an end in a similar way, only there are three perfectly architectural curves marking its terraced descent, and although throughout its course this road is above its sloping banks, where the cover descends, the bank to the left of it rises high above it, and then is gradually reduced in height.

Lengths of road that are covered and come to an end, are not made for the pleasure of making them, and in any case where they do end we are invited to look around. The three great cage hangars, commodious as they are, do not altogether satisfy curiosity, or excuse sufficiently the preparation evidently made in this sector.

On the wide banks that seem to slope at the left side of the road opposite the cages, there are some incidents which give one *furieusement à penser*. On a lawn-like surface which seems to have escaped as if by a miracle the very universal peppering, are what we must take for two short rows of the foundations of wrecked houses at right angles to the road ; so much alike are they that they might well have been cast in the same mould, and there are no signs of debris if we except some blistered-up masses like a short string of big beads on the lower row. How the shells managed to come plump into the houses every time, or almost every time, without in the least upsetting the pretty lawn which surrounds them, is quite a mystery, which only the German camoufleur who really was overworked on this job can explain.

There are two rows of ruined houses lower down, differing slightly from the others, but still made in one mould and which were equally clean targets.

It is not unreasonable to suppose that these sham evidences of solid earth reveal its hollowness. Long slopes leading down from the side of the road-cover gradually to the ground, obviate shadow and evidences of bulk, and under them there is room for large numbers of men and much material.

Now we see why the elaborate ground-picture was made alongside. Without it, attention would have been concentrated on the informing incidents on either side of the road. Also the cart-tracks have their solidifying function to perform, although some of them begin in the middle of fields and others stop illogically short. A sort of "can't be bothered to take them further." One of the first reasons for suspecting the ground-pictures was the fact that the traffic should have left the road (which is never consistent in its width) at one point, and crossed the shell-pitted, heavy-going cultivated ground in order to get on to the road again at its junction to the north, which we have shown is covered in.

PLATE 30.

GERMANS SAFE UNDER BATTERED RED CROSS CAMP.

The arrow points to descent of covered-in road.

Leaning screens among absurdly small 'paste-board' houses.

Note descending planes alongside the road.

Screens alongside covered road to imitate houses.

Five metal huts outspread and raised on timbers.

Leaning screen on the field

DRAWINGS OF SOME OF THE INCRIMINATING DETAILS IN THE RED CROSS CAMP.

XII

RED CROSS CAMP

In this other position near by, where the other road-cover comes to an end an old Red Cross Camp has been cleverly used for the concealment of German troops. A row of old huts with their sides outspread are raised on timbers high up above the ground-level. On the road side of them remark that camouflage material in imitation of wide paths is brought up to their roofs, and we may judge that that is the general level of this cover till it reaches the side of the covered road; beside which there is a row of screens, which, with their cast shadows, might be taken for houses. Ergo, it is solid ground.

Metal huts are not raised up on timbers for the mice to go under. And if we wander along this side of the road to the north, we shall see the wide lean-to's against it, a couple of diminutive huts on one, casting very much longer shadows than the bigger erections, and near to them the village houses alongside the road.

Neither houses nor huts are usually erected on steep slopes, nor in normal conditions are great leaning screens, of which there are so many in this area, to be found.

There are many other camouflage evidences in this photograph, but what follows is most striking.

There is one thing of the greatest importance to consider in the making of camouflage, and in the reading of it, and that is "proportion." Pains are taken by people with a paint-pot to make a military hut look like a cottage without additional width, and the ordinary roof incidents; it never will; it is always so much narrower. Here some tiny and roughly modelled Earl's Court houses—with no roof incidents—are at the top of the road; they are so much smaller than the huts (and there are leaning screens amongst them to make more), that the whole of them could be packed away in three of the huts of the Red Cross Camp. This will be seen in the photograph and the enlarged drawing of part of it. And, on reference to several examples given in these illustrations, it will be noticeable that village houses are about as wide as the high-roads, often wider, and leaning screens are not usually found among them.

It may appear absurd to have to labour so obvious a point, but no loop-hole must be left for those who won't see. They are the people whose attention was drawn to these German methods before these two examples of it were put up, and in time for them to have been able to keep an eye on the proceedings, while the buildings were in process of erection. In good time, in fact, for us to have kept watch on what was going on in this way behind the German lines, before the almost disastrous surprises of the March offensive.

In the opinion of those who were using these two photographs, there was nothing of interest in them ; only a gun position was marked. They were just two chance ones that casually come to hand.

Here are examples of the system used under our very nose during an advance, instances of course amongst many, of what the Kaiser described as "camouflaging the ground" to make it impossible for observers to see the preparations. And, as the captured instructions go on, a similar provision ordered that no new structures were to be erected on the prechosen ground. Why prechosen ground then ? and why structures ? In our camouflage there is nothing that could be described as structures. This incriminating description was obviously intended as a blind ; the blind, it appears, was accepted on our part through lack of knowledge, of art, and the faculty to think out a problem. Important as it may be to detect a camouflaged position already completed, more important by far, from the point of view of "Intelligence," is an understanding of the methods employed in constructing it, for the signs of serious preparation, once discovered, indicate not only where, but probably when, an offensive may be expected. But all this knowledge was thrown to the winds ; it involved a confession of failure.

Unfortunately, the effort to get those facts through at a critical time left no leisure to make drawings or enlargements of the photograph such as there are here, and very few laymen knew how to look at an aerial photograph. Even airmen rarely use a magnifying-glass, and any poor light is good enough for them. How they could expect to find incriminating clues, unaided, passes comprehension. There was ever the same incredulity right up to the end, in spite of the illuminating fact that bombing airmen were warned not to confuse an Earl's Court city with its real counterpart on the Rhine put up by camoufleurs to fog them.

Now that the existence of this camouflage cannot be disputed—and hitherto no artist of standing, painter or sculptor, including the most eminent living, who had been shown the photographs had questioned it, one of them with war experience enthusiastically describing it as perhaps

the greatest wonder of the war—efforts will probably be made to minimise its value. Let us consider the matter from that point of view. What is not seen is the last thing to suffer in war, and the first essential to surprise, by which almost alone effective results have been obtained on either side.

Some fairly reliable statistics are available, and it is computed that the Germans lost in killed a million less men than the Allies immediately opposed to them, partly no doubt because of their greater industry in making dug-outs that were reasonably secure. But, since the demoralisation and thinning of their reserves by aerial attack in open country or under obvious natural cover was the main anxiety of our leaders (and we know how camps and concentrations suffered in that way) we see how it was that the enemy's divisions were made immune from such devastating attacks throughout the war.

And when we consider the inhuman methods which had been introduced, no great stretch of the imagination is needed to realise the havoc some of them would have made in these practically hermetically sealed areas, where the Germans contrived to cover men and dumps by an imitation of the landscape as near up as the Amiens front, during the long wait. We may conclude that similar structures—seeing that by experience the Germans knew we had ignored them throughout the war—were up for the March offensive.

If the vice of illogical crabbing had given way to the virtue of intelligent investigation, the worst of the surprises would have been averted; for the German method was found out just in time.

XIII

REFLECTIONS

A Story with a Moral

Once upon a time, the fame of a monarch's wisdom had spread so universally that the Queen of distant isles, to test this far-famed wisdom, journeyed to the court of this King. During her sojourn, on one occasion the controllers of all the King's horses and all the King's men were summoned to assist their Sovereign, should his wonted resourcefulness fail him. The Queen guest had placed at some distance from the King a real and an artificial flower, and neither on any account was to be touched or smelt. And the test was, a decision as to which was which.

The King courteously turned to his advisers and invited them to decide.

Unfortunately, the courtiers knew very little about flowers, and had never dreamt of the possibility of making imitations of them. So without any thought, for thought without knowledge is well-nigh useless, they decided that there was no difference.

Thereupon the King motioned an attendant to open a window, and soon after a bee was seen by him to hover over one of the flowers. When the King pointed to the bee and knew in his heart which was the artificial flower, the courtiers were hurt to think that the humble bee, who had neither gold lace nor insignia of office, not even spurs, but only a sting, should be thought by their King to know more about its own job than they did.

No record of the bee's activity was ever entered in the archives of the Kingdom, for the controllers of all the King's horses were, oddly enough, also the keepers of his archives.

The story is only traditional.

Is Camouflage Unchivalrous?

Expression has been given to the idea that there is a lack of chivalry in the way that art is applied to war. Did men fight hand to hand, something might be said for this contention, but great armies and all their movements are now overlooked as are ants crawling about the ground;

the mass of them attacked far behind the fighting line by bombing airmen, or by shells fired from distances varying from one to twenty miles or more, to which the sufferers can themselves make no sort of reply. Those who consider defensive concealment unchivalrous can never have visualised the conditions of modern war. Even when art may be used to effect surprise it is doing no worse, but practically the same thing as the general who is pitting his brain against his opponents. That is known by the name of strategy or tactics.

It is clear, then, that the art which merely replaces the defensive or offensive concealment which nature in earlier wars afforded needs to be developed to a high pitch of efficiency; for the side which neglects it will be unduly exposed to the onslaughts of an adversary who will be concealed, and whose whereabouts cannot be detected.

. . . . .

If we could be certain that wars would cease, camouflage and all that belongs to it could be relegated to the war museum, and regarded as a curiosity; but prudence dictates that this, among the other military sciences, must continue to be taught. One may be pardoned then if in these rambling reflections systems which have been found defective or an outlook lacking in perspective are brought under critical review. This, it may be hoped, will help towards a reconsideration of the possibilities and the functions of a new and necessary factor in war.

. . . . .

In the course of these notes, what may appear to be extravagant claims for an art which, with us, has never been valued as anything better than (to use the current phrase) a "side-show," which could well be superintended by a lottery choice, are claims not disproportionate because they are advocated by a student of this Cinderella among the military arts, but are put forward on the grounds of common sense and of its special utility in view of the revolution which warfare has undergone; and on reflection these claims will be found not extravagant, but expedient.

The Reader of Aerial Philosophy

In order that the sense of proportion may be preserved, the interpretation of Aerial Photography, although in practice an inseparable twin to Camouflage, claims first attention.

The art which discovers is of greater value than the art which covers; that, in the nature of things, cannot be perfect.

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For if the other side knows, and we do not, our attempts at disguise are but an optimist's paradise, and we fight him blind, or at least with but one eye to his two.

Generals tell us that the principles of war have not changed. This, of course, applies to the highest strategy; but the means to effect such strategy are so different from what they were, both in kind and quantity, that the likeness between the latest and any preceding war is hardly recognisable.

. . . . .

Cavalry, except in very open country, has but few opportunities, and is entirely superseded by the airman for the invaluable work of reconnaissance. What in the old days may have deceived the mounted scout has now to face detection from the sky. It is the airman to-day who feeds the army brain, and what faces him must be made to deceive him.

Intelligence is therefore largely made up of the results of a fight between the camera and the camoufleur. Where the man behind the camera has it all his own way, there the functions of camouflage have not been visualised.

Let us suppose that the German was sometimes fogged by the one sound camouflage method we introduced rather late, namely, the stretched flat fishing-net over guns, which eliminated shadow when superintended by artists. That saved guns and men. So much to the good; but, like all similar methods of disguise with us, was but of limited tactical value, whereas forethought and industry, on the other side, not only hid masses of men and material, but intentions of real strategic import, which we failed to recognise even after it had been demonstrated to those responsible for former failures, that the laws of nature had a hundred times been here contravened by the hand of man.

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But what are these particular laws of nature? Queen Elizabeth, the shrewdest of women, would have no shadows in the pictures painted of her. How many men, untrained in the arts, know what a shadow is, or what it means? What part of this subtle side of art, known to the Germans as "skiagraphy," is grasped by the average man or boy? The whole art of camouflage, for colour hardly counts and has no effect as such from the height from which it is seen in these days of anti-aircraft guns, has to be based on an undoubted knowledge of this skiagraphy. Whatever the camoufleur does must be proof against tell-tale shadows, or even tones, in any effect of sunlight.

To set men, then, without a good art training to detect the skilfully designed imitations of nature from the real, in a microscopic photograph of it, is to court failure. To set men even with an art training, who have but a scant idea of the technique of war, and no faculty for deduction, is almost as futile, although the practice of the arts makes for logic, for the co-ordinating of second-hand knowledge is less effective than the co-ordinating of one's own direct experiences.

If our Command is to fight with its eyes fully open, it will be when exact science has taken the place of rough guessing. Sir Joshua Reynolds says wisely, "The eye only sees what it knows." A knowledge of nature as pictured from an unaccustomed aspect is the first essential—that is a key to the rest. No one had that before the war. The aerial pictures we then had gave us only the obvious; and the prevailing idea that a photographer is the right person to guide us in this matter, because photography is the medium through which a picture is obtained, is as logical as requesting a compositor to translate and annotate an abstruse work, because he set up the type for its printing.

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A sculptor models in relief by reproducing in his clay the areas of the shadows and tones seen in his sitter's face; the painter produces a similar effect by similar searching observations.

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The photographer's picture is made by the sun; he makes no personal effort to reproduce or analyse. The sun reproduces for him. His main concerns are purely mechanical, not analytical as are those of the artist, who knows what is meant by the perspective of shadows, and will see where there are other abnormalities besides those for which he has been asked to look, and would see after careful study what escapes the photographer.

Take, as an example, a feature in the Red Cross Camp (page 46) not yet analysed. We see the rounds of white made to imitate circles from which tents have been removed; the photographer has taken those for granted. The artist's attention is at once drawn to what he knows through his study, is in relief, and then sees that these rounds are not only very irregular, but that there are deep depressions around them; and so discovers constructional features which could have no place in the immediate neighbourhood of tents. If, added to his artistic experience, he has that of the practising camoufleur who has had to make similar

constructions, and used devices to prevent detection, the solution of the problem is but a matter of thought and time.

It is fairly obvious that since camouflage, negative or positive, is, or should be universally used, on the principle of setting a man who knows the game to catch another, at least the directors of aerial reconnaissance should be artists skilled in camouflage construction. These considerations point to the type of man and the type of education called for.

The Camoufleur

The camoufleur is, of course, an artist, preferably one who paints or sculpts imaginative subjects, with some deductive faculties. He must leave no clues for the detective on the other side in what he designs or executes, and he must above all things be resourceful. But his imagination and inventiveness should have free play.

The landscape in modern war is a collection of significant footprints, which lead or mislead. If these footprints are to be covered or disguised, or what is better still obviated, then the camoufleur at the outset should be immediately under the Command, the controller of the whole of his war landscape from the bases to the fronts. We may infer that the German camoufleur before a campaign would have a complete photographic survey of territory likely to be fought over from which to think out his schemes, about which he would confer with the High Command. The camoufleur's knowledge of his subject and the means at his disposal, the faculty to adapt them, or to improvise what may be called for by new and changing conditions, make his advice as necessary to a leader as that of the directors of artillery, transport, or signalling, or any such auxiliary which is to the army as a limb to the body. His place is even nearer to the brain-centre, and his work is of the nature of a prelude.

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Not only is he essential to the Command in any particular campaign, but some knowledge of the principles of his subject should henceforth form part of a general military training, so that officers may understand something of its resources, and in particular the discipline that may help, and without which camouflage is a dead letter.

Waggon-tracks, diagonal paths across fields, or any indications of work-wear, which lead the eye to otherwise disguised batteries, dumps, or concentrations, are but the silver trail of the slug, and there is nothing in the landscape so pregnant with meaning or so easily picked up. To the

armies which have been fighting, the theory of this at least is by now a commonplace ; but what about the armies that have yet to be trained ? The gunner's specialised mathematics will be of little service to him if he is not taught to select a position for his guns which, besides giving him a field of fire, offers facilities for his transport up to it that will tell no tales ; for the disguising of his batteries from the enemy airman ; for the alternatives which may fog him, or the means to make his dummies live. If he has not grasped this, his mathematics will be as short-lived as his guns.

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Whatever his capacity to employ the arms under him, the commander who makes use for his reserves of tents and huts of the present designs, even though they be daubed with the prevailing futile tones, will in any future war find those reserves thinned and demoralised before they can be brought into action. He would do wisely not only to consult his camoufleur about the preparations and about the selection of positions, which, every other military consideration taken into account, could be secured against discovery by the enemy scout, but to redesign his tents and hutting also.

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Tents, by the way, if ever they are used, should be as dark as they can be made. A light mass casts as deep a shadow as a dark one, but is made more conspicuous by the contrast, and spots of light are the most easily picked up.

But well-set routine takes years to eradicate. The manufacturers, to whom no war experience was passed on (the camoufleur had to colour his stuff after it was delivered) went to the extra trouble and expense of even bleaching their canvas. A more intelligent firm with some war-sense made a rich green canvas ; but in drawing attention to it one was told that more than enough of a grey sort had been ordered, on the advice of the airman. Whatever the airman sees from a height is greyed by atmospheric effect, it does not necessarily begin by being grey, and every colour will retain in the photograph a tone value relative to its surroundings, for the actinic properties of colour are a very different thing to their visual properties.

In this connection what follows should be illuminating and interesting for the student to consider. The contrasts between the tones of near and distant planes and objects seen in a picture, or in an ordinary horizontal photograph, do not exist in the vertical photograph.

Everything pictured is on one plane. No one thing is sensibly nearer

to the lens than another. Everything is, as it were, in the foreground, and therefore there is no aerial perspective. So that in a picture taken on a bright sunny day from any height up to twelve thousand feet or even more, every object or incident will be as clean-cut as though it were in the foreground of an ordinary photograph.

This does not apply to the airman's personal view of the landscape. The intervening atmosphere makes his view naturally more and more obscure and paler, the higher he rises.

Take another aspect where the camoufleur's knowledge of natural phenomena, with the co-ordinating of existing means, comes in, which can best be illustrated by the choice of the month of October for the attack on the Italian front in 1917.

The Carnic Alps run east and west. The sun in the late autumn rises and sets some degrees below the east and west, so that there is a constant shadow to the north of those mountains in those months, and across the valleys when the sun is out; that is when reconnaissance photographs are made. When it is understood that what is in shadow in the photograph is practically indistinguishable, it is easy to see how it was possible for the Austrians coming from the north, to conceal concentrations on their side—the shadow side—of the mountains, within striking distance of the forces to the south of them, where in any case a minimum of camouflage precautions would be needed.

In such a case photographs taken on a cloudy day would give, if not perfect results, at least better than could be hoped for, when the sun would make dark shadows, the depth of which would be intensified by glaring snow on some of the peaks.

At Home

Even here at home, the need for the camoufleur's influence is patent. The engineer who, in making gun positions, throws light soil down the face of a dark cliff is thoughtlessly giving his position away, as does the gunner who selects obvious sites for batteries, when others more difficult to locate from the air or the horizon would at once occur to the landscape specialist. The constructor of whatever may be required for military purposes will henceforth need to design on what may be called invisible lines. It is here mainly a question of avoiding sharp angles, and definite areas of marked shadow; faults which never fail to catch the eye, and which present a hopeless task to the camoufleur. Prevention is better than cure.

Where the material employed, such as hardened steel, or where the

specific use of the object cannot be made to conform readily to such designing, as with guns or tanks (although the German tank was from the point of view of invisibility better than our own), then provision should be made for fixing securely to those objects what may be found best suited to reduce the risks of detection in all conditions of sunlight.

The question of aerodrome planning and construction on sound camouflage lines, which during the war never seemed to trouble us, and the general development of the whole science, which, to those with experience and imagination open out almost endless possibilities, cannot be discussed in these pages.

But it is in peace-time that constructive thought can be focussed and experiment with "inspirations" which appear to promise fruitful results can best be made, at a minimum of the cost and the wasted and misdirected effort which are occasioned in war-time.

Those revolutionising factors which make up practically the whole subject matter of this book will, without much doubt, continue their role in any future continental campaign. We must, in any case, expect an extended development of them, even though new ones may be tried. So that the lines which thought and experiment will take are fairly determined for us. Much can yet be learnt from co-ordinating experiences in this war, and in the gathering in of a reliable data, upon all that has hitherto been tried with effect on all sides.

Even from failures something may be learnt, but the elimination of what in the opinion of those capable of judging without prejudice is unsound, should precede any effort at reconstruction or advance.

Natural Cover

Napoleon prepared some of the camouflage of his own day years ahead, by planting trees on his military roads. We can imagine what skilful use he would have made of the modern art in his schemes and stratagems.

But we may learn from the experiences of this war that only easily portable materials are of use in a moving campaign. The long waits between the German advances, to which their elaborate methods seen in the vicinity of Villers-Brettoneaux no doubt contributed, may have saved lives, but deprived the attack of effective impulse; the Allies had good time in which to consolidate their positions and defences. But, generally speaking, good artificial, innocent-looking cover has advantages over the natural; for every wood will in these days of abundant munitions, be

carefully searched if at all likely to be used for reserves, and is of doubtful advantage anywhere within range of innumerable guns.

A Comparison of Methods

We all learnt the advantages of covering in extensive areas, such as a field within its boundaries, for this is always the soundest form of shelter, unaffected as is a patch by seasonal or other changes around.

But the covering material used was canvas, which involved a series of pent-house ridges, and the employment in proportion of greater quantities of stuff than the hard German method, and offered also a more mechanical surface to the camera, and fewer facilities for artistic resourcefulness.

Our fishing-net flat-top was the most portable, and for this reason alone the most practical of covering materials. It made the elimination of definite shadow possible. By stretching the netting taut over any object, like a gun, or a whole battery, and threading it more and more thinly towards the edges with material such as grass, or rags of canvas, only a negligible shadow would be cast on the ground. These means could only suggest themselves to artists, who for some inscrutable reason were not supposed to be capable of organisation.

Lieut.-Commander Norman Wilkinson, whose brilliant invention of ship camouflage saved ships, lives, and the food supply at a critical time, is an artist. His method was not as some supposed conceived on the principle of colour assimilation, but on that of distorted perspective, to change the apparent course of a vessel.

Nothing could be more admirable than his far-reaching organisation, which called for initiative and imagination of a high order.

The mistaken policy of handing on to a third party the control of other people's ideas recalls the French proverb that "One does badly, that which one has not oneself conceived," and is invariably responsible for delay through much misunderstanding.

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To return to land camouflage and coverings. The German method of enclosing orchards and other large areas capable of sheltering from view great masses of men, railway sidings, dumps, etc., with open squares of wood fibre over wire, was effective. It could be employed in positions not suitable for the hard opaque system here analysed, particularly in summer, when the rainfall and drainage would not be a serious problem.

Immense quantities of this were discovered after the retreat, presum-

ably not before. It was not easy to burn, nor was there much object in destroying it. The principle was, to an extent, common to all belligerents, although no others used it on the same colossal scale.

Among the booty which fell to our share after the Armistice were many thousand yards of mosquito-netting. This would answer much the same purpose as our threaded fishing-net, and may have been used in much the same way by the Germans. Over the entrances of sunk aeroplane hangars they stretched widths of small-mesh wire-netting, to hide the black openings and the shadows that would be made in the excavated earth-works leading down to them. There are no signs of these shadow-eliminating methods in their set pieces, so they probably got this idea from us. To-day their modelled scenery system, and our shadowless method together, practically cover the ground of camouflage devised to screen from aerial observation.

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But, since familiarity facilitates detection, constant change is essential to success.

Road Screens

The hanging screens from side to side across roads, adopted by us and the French, were not comparable to the entirely covered-in roads of the Germans. The chief object of the covered road is to screen the come-and-go of traffic from kite-balloon observation. In dry weather the dust, and the moving shadows beside the road when the sun was low, would give away any activity on our roads.

Bad camouflage is so much labour lost, and often is difficult to judge by direct experiment. Only a faculty to visualise every possible contingency can guard against defects.

But the tendency to condemn an idea because a defect, which may not matter, is seen by some one who has not the imagination to realise its advantages, has often delayed the adoption of schemes that have proved invaluable.

The smoke-screen is an illustration of this. What we should now call a smoke barrage was proposed during the Boer War, and was condemned, just as the idea was turned down for far too long in this war. The Zeebrugge raid and the successful use of the Tank were only made possible by its employment. The mobilising of scientists also came late, but when it came its effect could not be over-estimated in a war in which science has played so important a part.

The Co-ordinating of Experiences

A camouflage clearing-house was badly needed. Although information may be lodged at the centre, often the left hand does not know what the right hand is doing on a long front.

One wonders whether the sappers who assembled the bridges on the Yser, which disappeared, as would all such visible and stationary things within gun-range, know the German device of sinking their bridges a few inches below the surface of the water?

Did we know in England or France that prisoners taken on the Italian front were astonished that we had no underground hangars? as they very naturally styled enclosures approached by covered-in passages —underground hangars which were afterwards searched for in vain, just as the Bertha was searched for in vain, because information lodged in London to all intents and purposes remained lodged in London.

Had the co-ordination of scattered intelligence which has since dribbled in as post-war information been organised, there might have been some hope that the logic of scientific evidences which no amount of questioning can efface would have been enquired into judicially.

There is undoubtedly room for improvement in a system which does not accept facts if they have no official imprimatur, and which so easily absorbs rumours such as the one industriously disseminated, and obviously from enemy sources, that "there was no German camouflage corps." This was always used as a clinching argument. It was official.

Negative rumours of the kind would, it might be supposed in the ordinary course not get very far. This one could be of no sort of service to us, but would be of incalculable value to the enemy, and was by no means the only opiate used to safeguard his methods from too close a scrutiny.

One has so often rubbed one's eyes and asked oneself whether the sanction of the Authorities is necessarily the sanction of authority.

Camouflage Administration

For many reasons the organisation of camouflage cannot be run on the lines of the accepted military establishments. The administrative and productive sides of the French equipment were independent of military control, and they worked admirably. It should be possible to devise means of separating the thinking, designing, and producing departments from the disciplinary. The knowledge requisite for adapting material

camouflage to specific military requirements, can in each instance be gathered by an intelligent and experienced camoufleur in the course of an hour's interview with military experts. And expert advice is always at the service of the camoufleur in designing in the first instance, or in correcting defects found out under active conditions.

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Our present system begins by placing at the head of the orchestra, as it were, a conductor to whom music is unfamiliar, and who therefore takes his inspiration and time from the big drum.

Imaginative foresight is the essential qualification of a camoufleur, and it is hopeless to look for this, from any one who has slowly to learn the elements of his functions from inferiors in rank, the camouflage soundness of whose views he can have no means of judging. The hound which carries another's borrowed brains and instincts in his stern is a poor leader in the hunt.

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And art, for camouflage which embraces so much when scientifically considered is a subtle art, cannot thrive under routine orders. A machine designed to run only on rails is circumscribed in its utility, and disaster awaits its leaving them. Although the producing of great quantities of material presupposes a certain standardisation of parts and some uniformity in the methods of production, which are perfectly managed in any well-run factory, great elasticity needs to be provided for, when changing conditions may call for immediate attention. Time is a vital factor in war, and resourcefulness alone, which depends on individual initiative, can save time and money, and guard against wasted effort.

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That resourcefulness is mainly seen in the capacity to use or adapt easily obtained natural material, or in the taking advantage of adaptable natural features. No guiding rules, apart from those which govern sound principles, can provide for these.

The whole art is in its essence as individual as that of the painter's own, and every instance of its application and upkeep needs expert supervision.

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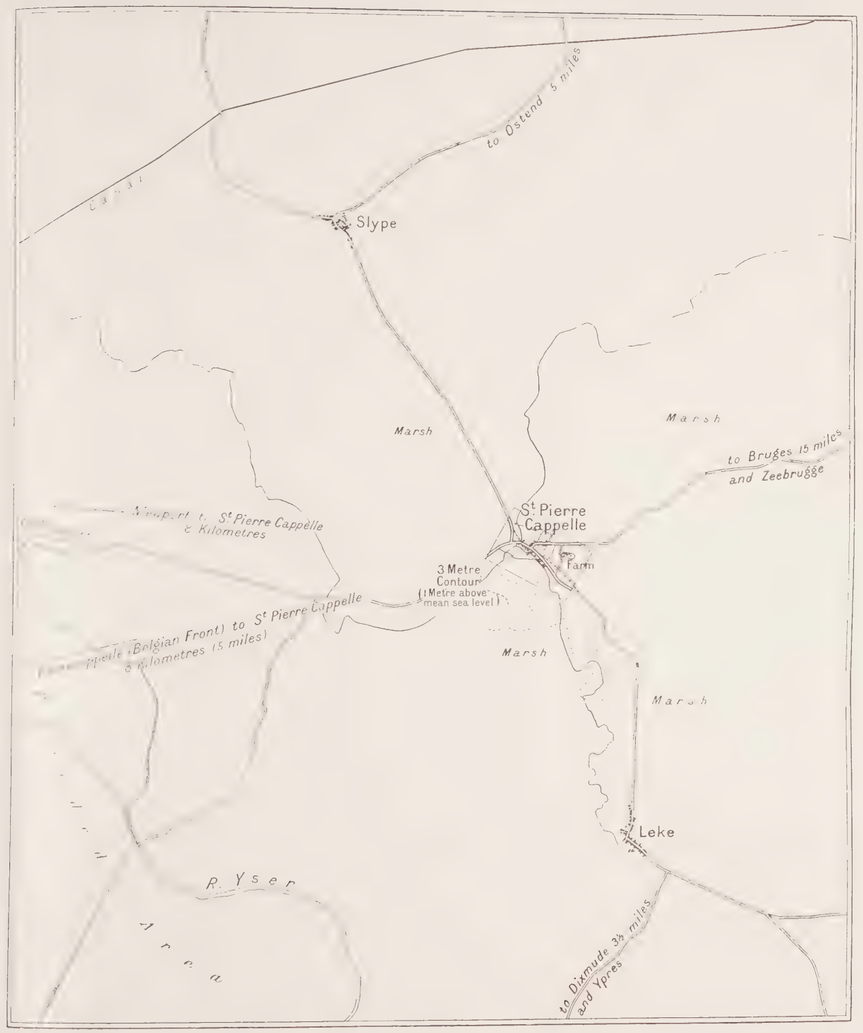
There need be no mistrust of the devotion or the all-round capacity of the artist in these matters. The most advanced and enlightened people of their age in Europe, the Italians of the Renaissance, knew how to

value the artist's naturally more than average faculty for visualisation, and entrusted the designing of the fortification of their towns and their arms to the painters and sculptors among them.

To walk in the footsteps—*longo intervallo*—of Leonardo da Vinci, Michael Angelo, and Cellini in time of war, makes their humble followers feel proud. They need no other reward.

Printed by Hazell, Watson & Viney, Ld., London and Aylesbury. England.



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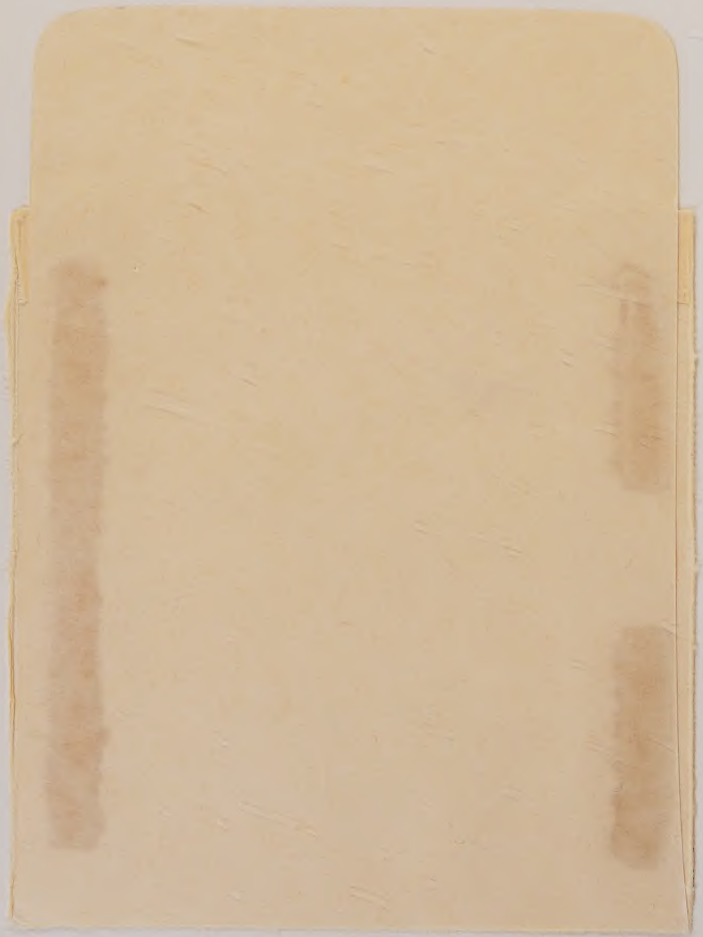

Bound by:
The COLLEGE BOOKBINDERY
CANADIAN UNION COLLEGE
College Heights, Alberta
MAR 31 1969

C0-DAQ-865